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THE

PRINCIPLES AND PRACTICE

OF

SURGERY.

Donald W. Charles Hood
Caius Coll

THE PRINCIPLES AND PRACTICE OF SURGERY.

BY

WILLIAM PIRRIE, F.R.S.E.,

PROFESSOR OF SURGERY IN THE UNIVERSITY OF ABERDEEN;
SURGEON TO THE ROYAL INFIRMARY, ETC. ETC.

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TO

THE STUDENTS OF SURGERY

OF

THE UNIVERSITY OF ABERDEEN,

IN GRATEFUL REMEMBRANCE OF

THE PLEASURE HE HAS UNIFORMLY EXPERIENCED

IN HIS CONNEXION WITH THEM,

AND IN TESTIMONY OF

THE LIVELY INTEREST HE FEELS IN THEIR

PROFESSIONAL PROGRESS,

THIS WORK IS DEDICATED BY

THE AUTHOR.

PREFACE.

In the preface to the former edition it was stated that this work was not put before the public with the design to bring it into competition with any of the valuable treatises on the same subject already existing, but simply in compliance with a wish which had been frequently expressed on the part of the students of surgery at this University to be furnished with a Compendium of my Lectures.

For their use it was prepared; and while I ventured to hope that others might find it not unserviceable, still it was my chief object that those should derive benefit, for whose especial use it was intended.

It has been my endeavour to combine simplicity of arrangement, and conciseness and clearness of description, with the elucidation of sound principles and practice, as well as to give a faithful account of the present state of surgical opinion on the various subjects treated in the work.

By economy of space, and reducing the size of the type, there has been added new matter amounting to nearly one-third of the former volume, and that without rendering the present more bulky than it.

I take the opportunity of acknowledging the assistance which has been rendered to me by my son, Dr. William Pirrie, in re-writing the chapter on Inflammation.

The wood-engravings are taken from drawings, many of which are delineations of preparations in my own Museum; others are of patients who were under my care; and the rest are from authorities which are duly acknowledged.

The drawings of the original illustrations were made by Mr. Cleland, and were afterwards executed on wood by Dr. Westmacott.

To Dr. Bennett I owe acknowledgments for the use of many wood-cuts, illustrative of the inflammatory process and of the microscopic characters of tumours; and to Dr. Redfern I would also express my obligations for the use of many, illustrative of diseases of cartilages. My warmest thanks are due to my Publisher, for permission to use the blocks belonging to two works remarkable for the excellence of their wood-engravings, namely, Mr. Bransby Cooper's edition of Sir Astley Cooper's "Treatise on Dislocations and Fractures," and Mr. Liston's "Practical Surgery." With beautiful and instructive engravings from these many pages of this work are adorned.

247, *Union Street, Aberdeen,*
October, 1860.

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THE

Principles and Practice of Surgery.

CHAPTER I.

INFLAMMATION.

That a perfect acquaintance with the doctrines of inflammation is of the utmost importance to both the surgeon and the physician must be allowed when it is considered, that in most of the morbid changes to which the human frame is liable, inflammation presents itself at one period or another. To the surgeon it is interesting, not only as a destructive morbid agent, leading to consequences more or less disastrous—to ward off which is the constant aim of his care and treatment—but also in many cases as a healing medium, through which injuries are repaired, or conditions induced which act as safeguards against greater evils. So the skilful surgeon, taught by careful observation of natural processes, is often induced to use inflammation as a healing instrument; that is, he strives artificially to excite inflammation, in the hope that, by its operation, he may either repair a deformity, or produce some change conducive to the welfare of his patient.

When we speak of any tissue as being in a state of inflammation, we mean by the expression, that the natural nutrition and nervous energy of the part are perverted, that certain remarkable changes, to be afterwards described, have taken place in the blood and its containing vessels, and that the normal healthy affinity between the blood and the tissues of the part is deranged.

Inflammation, to use the short but expressive language of Dr. Alison, may be defined as a "peculiar perversion of nutrition or of secretion," attended with various abnormal conditions of the blood and its vessels, the most essential of which is exudation in the part affected.

For the better elucidation of this subject, the various phenomena observable in a common case of inflammation, and the general treatment of the inflammatory process, may be detailed under the successive heads of—

1st. The local changes observable by the aid of the microscope in the part affected :

2nd. The local symptoms arising from these changes :

3rd. The general or constitutional symptoms :

4th. The results, events, or terminations of the inflammation : and

5th. The general principles of treatment, with the rationale of their operation.

LOCAL CHANGES.

By the aid of a microscope the following phenomena may be readily seen in the transparent parts of animals, as in the web of a frog's foot, after the application of a stimulus capable of exciting inflammation, such as alcohol, or acetic acid.

I. The capillary vessels are narrowed, and the flow of blood through them accelerated. This stage is of very short duration, more especially when the stimulus is very powerful; in which case it may pass so quickly into the next as to escape observation.

II. The vessels become greatly distended, and the flow of blood is slower than usual.

Some have doubted whether constriction of the vessels ever takes place prior to their dilatation. This seems to depend a good deal upon the kind and the strength of the stimulant employed ; thus, if the stimulant be mechanical, it will first occasion a momentary contraction of the vessels ; whereas a strong solution of salt or of sulphate of copper will immediately produce a marked dilatation of the vessels, unpreceded by any constriction.

Again, many writers describe the flow of blood as accelerated through the contracting vessels; but on this point Professor Paget remarks, "as the vessels are contracting, the blood flows in them more slowly, or begins to oscillate ; nay, sometimes, I think, even before the vessels begin visibly to contract, one may observe that the blood moves more slowly in them, as if this were an earlier effect of the stimulus ; nor have I ever seen (what has been commonly described) the acceleration of the flow of blood in the contracting vessels."

Again, he remarks, "It has been commonly said, that, as the vessels contract, therefore the movement of blood becomes more rapid in them, as when a river entering a narrow course moves through it with a faster stream ; and that then, as the vessels widen, so the stream becomes, in the same proportion, slower. But this is far from true ; the stream becomes slower as the artery or vein becomes narrower by contraction ; and then as the tube again dilates, the stream grows faster ; and then, without any appreciable change of size, it may become slower again, till complete stagnation ensues in at least some part of the bloodvessels."

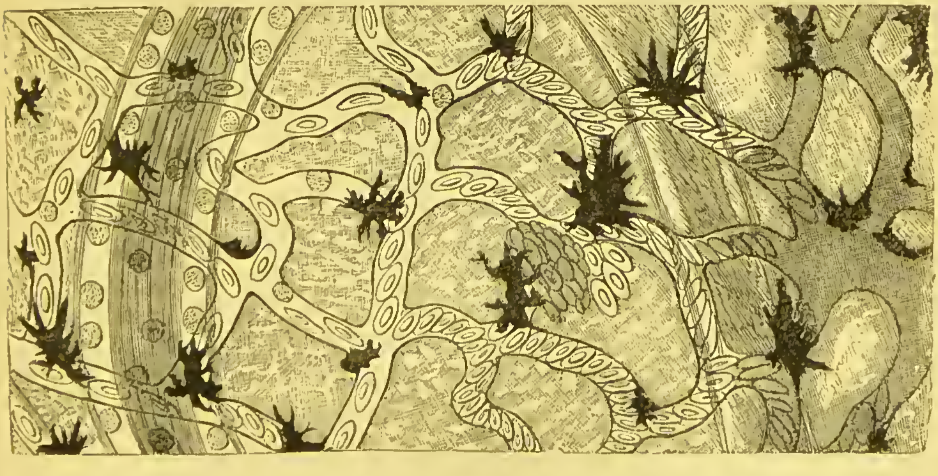
The dilatation affects alike the arteries, the veins, and the capillaries; and may be either hardly perceptible, or such as to double or treble the normal diameter of the vessels. Very frequently the dilatation of the vessels is accompanied with a change in their shape; for they are often observed to be elongated, and to have a tortuous or wavy form. Such, beyond all doubt, are the first and second abnormal changes produced by the application of the stimulus.

III. The blood flows irregularly: it oscillates, that is, it goes backwards and forwards, and often is absolutely stagnant for a time. In the neighbourhood of the parts thus affected the vessels are distended, and the circulation through them is more rapid than is natural; and over all the affected surface new vessels become visible, the explanation of which is believed to be, that the red particles are received in abundance into vessels which previously contained them in such small quantities as not to be perceptible.

IV. The vessels become greatly distended, and the circulation of blood ceases entirely.

Besides the general distension of the entire circumference of the vessels, Kolliker, Hasse, and other German pathologists, and Paget and W. Jones, in this country, have observed that, in some cases of inflammation, the vessels had fusiform dilatations of their whole circumference only at particular points of their course; or presented, at short intervals, aneurismal pouches sprouting from one side of their walls. These partial dilatations are not, however, peculiar to the inflammatory state; and have been ascribed to structural degeneration of the walls of the vessels, in consequence of which they cannot, through their entire length, present an equable resistance to the increased pressure of the blood.

Fig. 1.



An exact copy of a portion of the web in the foot of a young frog, after a drop of strong alcohol had been placed upon it. On the left of the figure the circulation is natural; in its middle portion the column of blood is oscillating, and the corpuscles crowded together; on the right the circulation has stopped, and exudation has taken place. About the centre hæmorrhage has occurred, owing to laceration of a capillary vessel.—Bennett.

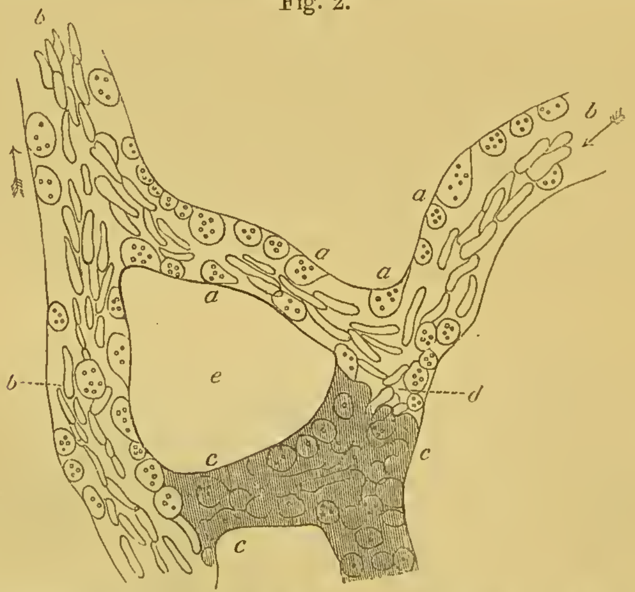
V. Blood becomes effused into the surrounding textures by rupture of the vessels, and liquor sanguinis is exuded without rupture.

VI. Besides these changes in the size of the vessels and the movement of the blood, others are observed in the relation of the corpuscles of the blood to each other, and to the walls of the vessels.

In the transparent parts of animals in the natural state, the red corpuscles of the blood circulate in the centre of the bloodvessels: and on each side there is a space containing the liquor sanguinis, and the lymph corpuscles. Two currents are thus circulating, one in the centre, consisting of the red corpuscles, the circulation of which is very rapid; and the other at the sides, consisting of the liquor sanguinis with the lymph corpuscles, the circulation of which is comparatively very slow.

In inflammation the following abnormal changes may be seen. The lymph corpuscles proceed very slowly in the lymph spaces, and some of them become adherent at certain parts to the sides of the vessels. The central column of red particles, as the vessels distend, becomes enlarged; the corpuscles encroach on the lymph spaces, and gradually come into contact at some parts with the walls of the vessels; they become adherent to each other, so that their individual forms are no longer perceptible; and ultimately, the vessels giving way, some blood becomes extravasated, and the liquor sanguinis exudes through the walls of the vessels. The exudation of liquor sanguinis constitutes the essential phenomenon of inflammation, or, in other words, its characteristic or pathognomonic feature; while the other phenomena constitute the state of active congestion, which is

Fig. 2.



a. Colourless globules adherent. *b.* Blood discs, still circulating. *c.* Dense, stagnant, homogeneous mass. *d.* Corpuscles in oscillatory movement, becoming detached from the impacted mass.—WILLIAMS.

one step short of inflammation. It is of importance not to confound congestion leading to inflammation with the inflammation itself. Effusion of serum, capillary hæmorrhage, or extravasation of blood may take place in consequence of other morbid conditions; but in the present state of our knowledge, it is believed that inflammation never exists without the exudation of liquor sanguinis, and that the exudation alone is a proof of inflammation, and is therefore to be regarded as the essential phenomenon of inflammation.

The above-mentioned changes we see taking place under the microscope in the transparent parts of animals; and although we cannot apply this instrument to the same purpose in man, still many facts lead us to the conclusion, that the same phenomena occur in him as we see in the smaller animals.

LOCAL SYMPTOMS.

The principal local symptoms are the six following: redness, swelling, heat, pain, abnormal exudation, and impairment of function.

I. REDNESS.

Cause.—This symptom arises from an increased quantity of blood in the inflamed part, not only in the larger vessels, but also in the capillaries. The smallest of the capillaries, in their natural condition, are invisible to the unassisted eye, and allow only one blood globule to pass through at a time; but in inflammation they become so enlarged as to allow several to pass abreast. In some inflammations, the redness is partly caused by extravasation of blood; but in most instances it depends on enlargement of the capillaries, and the consequent increase in the quantity of blood contained by them.

Varieties as to tint, extent, and form.—The tint of the redness varies in different inflammations:—in common acute and sthenic inflammation, it is bright and vivid, like arterial blood; in chronic and asthenic inflammation, it is more of a dark or purple hue; in erythema, it is a bright rosy red, and perfectly continuous; in erysipelas, it is of a darker red; in erysipelas attended with great bilious derangement, it is of a yellowish red; in syphilitic inflammations, it has something of a copper tinge; in scrofulous inflammation, it presents a peculiar soft appearance; and when the inflammation is about to result in gangrene, it is of a dark purple or blackish hue.

The *extent* and *form* of the redness vary according to the character and intensity of the inflammation, and the nature of the tissue principally involved. In phlegmon, for example, it is circumscribed; in erysipelas, diffused; in phlegmon, it is gradually and insensibly lost in the surrounding parts; whereas, in the erratic form of erythema, it presents a distinctly defined margin, or may be said to be abruptly circumscribed. With regard to *form*, it may be linear, as in inflammation of veins and lymphatics; or punctiform, as in inflammation of the villi of a mucous membrane, which is not itself involved; or ramiform, as when the smaller arteries and veins only are seen distended; or capilliform, as when the distension of some of the capillaries is also seen; or uniform, as in erysipelas, when there is one continuous blush of efflorescence.

The presence or absence of redness is not, by itself, a proof of the presence or absence of inflammation.—Redness alone does not constitute inflammation; for it often exists without inflammation, as in the crimson spot of the hectic cheek, or in the blush of shame, or when produced by friction, or by the application of heat, or by the cupping glasses. On the other hand, the absence of redness is no proof that inflammation does not exist; for some inflammations, as those of the cornea and of the arachnoid membrane, are attended with opacity instead of redness. It is only in conjunction with other local indications that redness is regarded as a symptom of inflammation. The diagnostic peculiarity of inflammatory redness is, its continuing so long as the inflammatory action, which causes it, still remains.

II. SWELLING.

Cause.—The swelling may, in the early stage of the inflammation, be occasioned in some slight degree by the increased quantity of blood; but it is chiefly caused by the effusion, into the intervascular spaces, of some matters called *products* of inflammation. The nature of these matters will afterwards be considered.

The *extent* of the swelling depends partly on the kind and violence of the inflammation, the more violent the action, the greater generally being the inflammatory effusion; and partly on the nature of the part affected, being greater in loose and relaxed textures of a supple and dilatable character, such as cellular tissue, than in those of a hard unyielding nature, as bones. In loose textures, generally, the swelling is most remarkable.

The *consequences* of swelling vary much, according to the importance, the delicate nature, the situation and relations of the part affected. In textures superficially situated, which do not perform a function of great importance, which are loose and dilatable, and so placed that the swelling cannot prevent the performance of any function essential to the animal economy, the occurrence of swelling is followed by relief, and is therefore favourably regarded by the surgeon: whereas, in some internal organs, as in the sub-mucous cellular tissue of the glottis, and in many textures of a delicate nature, a very slight degree of effusion is sufficient to lead to a fatal result; and in some firm and unyielding structures it not unfrequently causes the total destruction of the part inflamed. The intelligent practitioner, therefore, in forming a correct judgment of the consequences likely to result from the effusion of products of inflammation, will be guided by a consideration of the site, relations, nature, and importance of the affected part.

Of swelling, as a symptom of inflammation, it may be remarked, that, like redness, it is generally greatest at the centre of the inflammation,—that it is, in most cases, gradually lost in the surrounding parts,—and that alone, as may be proved by many examples, it is no certain evidence of inflammation.

III. PAIN.

Pain varies in kind.—There are great varieties in the kinds of pain, depending on the part principally affected. It may be of a burning, tingling, or pruriginous character, as in certain inflammations of the skin,—or throbbing, as when the cellular tissue is affected,—or extremely acute, sharp, and lancinating, and greatly increased by stretching the inflamed part, as in inflammation of serous membranes;—or, as sometimes, dull, heavy, or obtuse, of an exceedingly oppressive character, and attended with a feeling of nausea, as in inflammations of some glandular organs;—or, as at other times, of a severe, bursting character, as in inflammations of ligaments, fasciæ, periosteum, or bone.

Pain varies in degree.—Pain, in different kinds of inflammation, varies much in degree, being, in some, exceedingly intense, so as to constitute by far the most urgent symptom, while in others, it is comparatively slight. In some inflammations, under certain circumstances, there is no pain. In general, the intensity of the pain is in the direct ratio of the firmness and unyielding nature of the part affected. For example, ligament, bone, and fasciæ—structures which, when sound, are endowed with little sensibility—are extremely painful when they become the subjects of inflammation. There is generally more pain in external inflammations, and in inflammations of the investing membranes, than in those which affect the substance of the viscera, or mucous membranes. In inflammation of some parts of mucous membranes there is only a sense of heat and uneasiness not amounting to actual pain. The pain is generally greater in common than in specific inflammations, with the exception of gout. Of inflammation unattended with pain, the following examples may be enumerated:—Insidious and indolent forms of scrofulous inflammations, in which extensive disorganization is often produced without the patient having ever been conscious of actual pain; inflammation in a part affected with paralysis, or consequent on the division of the sensitive nerve of the eye, or in cases where the sensibility of the patient has been benumbed by the habitual use of intoxicating liquors; inflammations of the lungs in low kinds of typhoid fever, which are very dangerous; and those inflammations which affect the mucous membrane of the urinary passages, in complete anæsthesia of the lower parts of the body. The absence of pain, therefore, is no certain evidence that inflammation does not exist; and it is equally true that its presence is no sure proof that it does. Of this we have examples in cases of neuralgia. There is in general no difficulty in distinguishing between inflammatory and neuralgic pains, the former being invariably aggravated by pressure, whereas the latter are not only not increased, but often relieved by it. Neuralgic pain is generally intense from the commencement, and sometimes subsides suddenly; inflammatory pain steadily increases while the inflammation advances, having been at first, perhaps, nothing more than a slight increase of the natural sensibility. The sudden subsidence of pain in violent inflammations is more to be dreaded than desired, as it gives good reason to suspect that the part has lost its vitality, from the inflammation having gone on to gangrene.

The *site* of the pain is generally the site of the inflammatory action, but in some instances it is at a distance from it; for example, in inflammation of the bladder or kidney, the pain is felt at the point of the urethra; in inflammation of the hip-joint, it is felt principally at the knee; in inflammation of the diaphragm, or upper part of the liver, the pain is at the right shoulder; in some inflammations of the brain, it is felt more along the spine; and in inflammation of the spinal cord, it is sometimes felt along the thorax, and in parts of the limbs, more than at the seat of the disease. In all such cases the pain is termed sympathetic, and is met with principally in those instances in which the parts inflamed and pained are closely connected together by function, or where the latter contain the terminal expansions of nerves whose trunk or branches pass through or near the former. To avoid errors in diagnosis, these peculiarities as to the site of the pain should be carefully kept in view.

Cause of pain.—The pain has been by some ascribed to compression of the nerves of the inflamed part by distended vessels and effusion; by others, to an exaltation of nervous function, or to a painful stretching of the nerves arising from the distension of their small nutritious vessels; and by others, to an impression produced on the nervi vasorum by the slight dilatation and elongation of the arteries during each impulse of the blood. From the facts, that the pain is great where the nerves are most liable to be compressed, and that it is always increased by pressure (unless when the pressure is steady, uniform, and such as to support the whole of the inflamed part), as well as from other considerations, it seems highly probable that pressure is the chief cause of the pain.

IV. HEAT.

Preternatural heat is usually characteristic of inflammation, and it was no doubt the general presence of this symptom, and an erroneous idea of the changes which take place in inflammation, that led to the adoption of the term, derived as it is from *inflammo*, a Latin word signifying to burn. This symptom, like redness, varies much in degree, according to the violence of the inflammatory action, and the situation of the affected textures: in acute phlegmon, erysipelas, and certain inflammations of the skin and mucous membranes, it is considerable, and causes much pain; while in some inflammations it is so slight as to be scarcely felt at all.

John Hunter made many experiments and observations with a view to ascertain the actual increase of temperature caused by inflammation. He excited inflammation in the vagina and rectum of an ass, and in the cavity of the thorax of a dog. In none of these instances did he ever observe the temperature to rise more than one degree above the natural heat of the part. He had occasion to operate on a man in St. George's Hospital for the cure of hydrocele, and on drawing off the fluid, he found that the thermometer, on being introduced into the cavity of the tunica vaginalis, stood at 92°; the next day, when inflammation had taken place, it stood at $98\frac{3}{4}$, being an actual rise of $6\frac{3}{4}$ degrees. He observed that on applying a blister to the chest, the difference of heat in the inflamed and surrounding parts did not exceed one degree or two: whereas on applying a blister to the extremities, which are naturally colder, the difference between the healthy and inflamed parts was found to be from five to six degrees.

These experiments and observations warranted the following conclusions:—That the increase of heat is not so great as the patient might by his feelings be led to imagine, or as a bystander might suppose before making the experiment; that the greatest rise of temperature is found where the inflamed part is considerably removed from the centre of the circulation, and where the natural temperature is several degrees below that of the blood at the heart; that the actual rise of temperature in deep-seated parts is not more than one degree, but that in parts remote from the centre of circulation it may be several degrees; and that in every instance the heat is below the temperature of the blood at the heart. It is in the parts remote from the centre of circulation that the heat is most distressing.

The thermometer, however, only measures the degree of actual heat, whereas what the patient experiences is the sensation of it; and when we consider, that not only is the sensibility of the inflamed part increased, but that the functions of the nerves also are increased and perverted, we need not be surprised that it is sometimes a very distressing symptom. An excellent writer on surgery has very happily remarked, "The heat of inflammation is partly actual, as ascertained by the thermometer, partly the result of perverted nervous function, estimated only by the patient."

John Hunter attributed the increase of heat to the increased influx of arterial blood. In all cases, animal heat is believed to be derived from the mutual action between the oxygen and the carbon and hydrogen of the tissues; and we may, therefore, conclude with Liebig, that together with an increased influx of blood, there is an increased amount of this kind of combustion, or an unnaturally rapid oxydation of the inflamed tissues.

V. ABNORMAL EXUDATION.

In every instance of undoubted inflammatory action, an exudation of blood plasma occurs, and according to the ideas now entertained, this symptom is essential to inflammation. On this subject I cannot deny myself the pleasure of giving the following quotation from Dr. Bennett's admirable “Treatise on Inflammation.”—“Pain, heat, redness, and swelling, have been made to play too important a part in our views concerning inflammation. They are only present when the lesion affects the external surface, and are by no means applicable when it attacks many internal organs. I have seen cases of encephalitis, where no pain or heat was manifested before death, and where no redness or swelling was to be afterwards discovered, although an undoubted inflammatory softening existed. Inflammation also may attack the lungs, liver, kidneys, &c., and yet one or more of these supposed cardinal symptoms be absent. Again, slight incisions, as those with a razor, are generally supposed to heal by means of inflammation, and so they do; but where is the pain, heat, redness, or swelling? In short, the symptoms of phlegmon, which so frequently come under the notice of surgeons, have been by them too generally applied to all inflammations. An analysis of these symptoms also will show that, whilst some depend upon the previous congestion, others are attributable to the exudation that follows it. Thus, the heat and redness are caused by the former, whilst the pain and swelling usually result from the latter. The presence of these symptoms, therefore, cannot be considered as essential to inflammation; whereas the state can never exist, however slight, or however severe, without exudation of blood plasma. Other pathologists have felt the difficulties which attend the considering exudation as a result rather than as the essential phenomenon of inflammation. Thus Dr. Alison observes, ‘In order to give the requisite precision to the general notion of inflammation, as a local change of the condition of any part of the body, it seems only necessary to include in it, besides the pain, swelling, heat, and redness, the tendency always observed, even when the changes in question are of short duration, to the effusion from the blood-vessels of some new products, speedily assuming in most instances the form either of coagulable lymph, or of purulent matter.’ If, instead of *tendency to*, we read *existence of*, effusion, the principle laid down is certainly correct.”

VI. IMPAIRMENT OF FUNCTION.

Impairment or perversion of function is an almost constant symptom, changing much in character according to the organ affected, and the degree and progress of the inflammation. In many cases the function is first increased, then perverted, and afterwards entirely arrested. Of many examples of this symptom, I shall mention only the following. The brain, when inflamed, no longer continues to perform its office as an organ of intellect, having its function at first perhaps exalted, as in delirium, and afterwards entirely suspended on the supervention of coma; the stomach is incapable, in inflammation, of performing its office as a digestive organ; the kidney ceases to be useful as a uropoietic viscus; the bladder becomes impatient of the least distension by urine, and the eye becomes intolerant of the slightest impression of light. The perceptions of taste and smell are lost in inflammations of the mouth and nostrils, so that the parts are incapable of performing their special functions, while, at the same time, their common sensibility is often considerably increased; and in inflammations of the ear, or of the muscles and vessels, the affected parts fail in the performance of their proper functions. In internal inflammations, derangement of function is frequently an important guide towards forming an accurate diagnosis.

CONSTITUTIONAL OR GENERAL SYMPTOMS.

The constitutional symptoms may be conveniently arranged into two general divisions:—first, the symptoms of sympathetic inflammatory fever; and second, the inflammatory appearances of the blood.

1. SYMPATHETIC INFLAMMATORY FEVER.

Various names have been employed at different periods to designate this disturbance in the general system. It has been called Sympathetic Inflammatory Fever, Constitutional Fever, Sympathetic Synocha, General Vascular Reaction, Constitutional Disturbance, Sympathetic Fever, Symptomatic Fever, &c.

The patient generally has a sense of coldness, rigors, lassitude, and feebleness, followed by heat and dryness of skin, and commonly by increased strength, frequency, fulness, and hardness of pulse. This is not, however, invariably the condition of the pulse; for example, in inflammation of the stomach and intestines, it is small and exceedingly feeble, there being an early and decided depression of the action of the heart, occasioned, as is supposed, by the combination of nausea with pain; and in inflammation of the brain attended by coma, the pulse is comparatively soft and slow.

Again, in cases where the tone of the patient's system has been lowered by previous debilitating influences of any kind, the febrile reaction is less decidedly marked, the pulse does not increase in strength or hardness, and the fever has more or less of the character of typhus from the commencement. The respiration becomes hurried, and there is often an uneasy sensation of oppression in the chest; the face is flushed, and the head generally hot; the patient is restless, does not sleep well, complains of much general discomfort, and of dull pains in the loins and limbs; he cannot command his attention, and both the will and the power to 'exert himself are diminished; he loses his appetite, and is usually thirsty; the tongue becomes white, loaded, and dry; the mouth is parched; the various secretions are deranged and diminished; the bowels constipated, the urine scanty and high coloured, the functions of digestion and nutrition interrupted; emaciation soon becomes great, and debility excessive; there is incapacity for any mental exertion, and, ultimately, the mind is apt to become confused.

It has been stated that a rigor or sense of chilliness generally occurs early in the attack, marking, as it were, the date of the invasion of the fever; but the same symptom may occur at a much later time, and then it generally has a very different significance.

When inflammation terminates in suppuration, the commencement of that process is very frequently indicated by a distinct rigor; and if it be of considerable duration, there is often a succession of shaking seizures, followed in the end by exhausting hectic.

With regard to this constitutional disturbance, we may further remark, that it is often very disproportioned to the size or importance of the part inflamed, as in some cases of tonsilitis; that it generally manifests itself subsequently to the local symptoms; but that in some cases, as for instance erysipelas, it appears prior to any local symptom; whilst in others again, as some attacks of pleurisy or peritonitis, the local and the constitutional symptoms manifest themselves about the same period.

Sympathetic inflammatory fever is especially marked by the absence of certain symptoms, which distinguish the different forms of what is called idiopathic fever, and more particularly by the absence of petechiæ, of any special eruption on the skin, of the peculiarly overpowering *depressio febrilis,* muttering delirium, *subsultus tendinum,* and stupor; in short, by the absence of those peculiar signs of derangement of the nervous system to which we give the name of typhoid symptoms.

2. INFLAMMATORY APPEARANCES OF THE BLOOD.

Soon after any part has been the subject of inflammation to any great extent, the blood presents certain characteristic appearances. But before these are detailed, certain changes observed in the relative proportions of the various constituents of the blood during the inflammatory process may be enumerated.

The chief appreciable change in the constitution of the blood is a great increase in the quantity of its fibrin, which, according to Andral and Gavarrat, may range from 2½ to 10 per 1000. It is, however, a very difficult matter to ascertain with any certainty the exact amount of increase of the fibrin; for no process has yet been discovered by which the fibrin and the white corpuscles of the blood can be well separated; and hence these last-named bodies are very apt to be included in all estimates of the amount of fibrin.

According to some observers, the red corpuscles become slightly increased in number during the very early stage of the inflammatory process; but all are agreed that, as the inflammation advances, these bodies diminish in number, falling considerably below their normal amount.

Many distinguished pathologists have stated that a great increase of the white corpuscles of the blood takes place during the inflammatory state, but several recent and noted pathologists, who have carefully investigated this point, state, that they found the same proportion of white corpuscles in the vessels of an inflamed part as they did in those of a healthy part of the same individual. The conclusion to which Dr. H. Bennett, Mr. W. Jones, and others came on this point, is now generally accepted; namely, that an increase of white corpuscles in the vessels of an inflamed part will be found in those cases only, where they are in unusual number throughout the whole mass of the blood, as for instance in weak and tubèrculous habits of body.

The other chief changes observed in the various constituents of the blood in inflammation are, a considerable increase in the proportion of its water, and a diminution of the albumen and the saline matters.

With regard to the fibrin of the blood during the inflammatory process, we may further remark, that it has an unusual tendency to separate from the colouring matter; and further, that there is an increased tendency to aggregation of its own particles during coagulation.

When blood taken from a person labouring under inflammation is received into a spherical, or into a deep vessel, and allowed to remain at rest, the two parts into which it separates itself, namely, the clot, cruor, or crassamentum, and the serum, present the following peculiarities:—

The clot is firmer and denser than that of healthy blood; the upper surface, which is of less diameter than the lower, is covered over with a whitish layer formed of fibrin, constituting what is called the buffy coat; and this surface is sometimes hollowed out into a cuplike form, in which case the blood is said to be both buffed and cupped. Under these circumstances, the coagulum is usually oval, but truncated at both extremities, broader below than above, and often adherent to the bottom of the recipient vessel. The coagulable

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lymph of surgeons, which is observed on cut surfaces, is identical in appearance and chemical characters with the buffy coat, and they, no doubt, are the same substance. The apparent ratio of the clot to the serum is variable, depending materially on the figure of the containing vessel. When the coagulating blood is contained in a spherical vessel, the particles of fibrin, being little removed from a common centre, are more powerfully attracted towards each other, yield a denser clot, and squeeze out more serum than when the coagulation takes place in a shallow, wide basin, when the particles are spread over a large surface. The clot, in the one case, is compact and small; in the other, being spongy and retaining much of the serum, it appears to be of a larger size, although the actual quantity of solid matter is the same in both.

But apart from the form of the recipient vessel, the extent, form, and consistence of the buffy coat is much influenced by the violence and duration of the inflammation, and by the character of the tissue involved, being much greater in inflammations of fibrous and serous textures than in those of mucous membranes or of the parenchyma of internal organs.

For example, in severe inflammation of a fibrous or serous membrane, the buffy coat is generally thick and consistent, cupped on the surface and puckered at the circumference, the red portion being also firm, and more or less globular; whereas in many well-marked inflammations of a mucous membrane or of a parenchymatous part, the buffy coat is frequently less thick, less consistent, and flatter on the surface; and the red portion also is less coherent, and partakes more of the shape of the containing vessel than it does when the inflammation involves a serous or fibrous tissue.

The term sizy is usually applied to blood presenting a copious, flat, soft, flabby, buffy coat, and a loose spongy red portion surrounded by serum in which will be observed some red particles distinct from that of the clot. In cases where the blood presents this appearance, Dr. Alison states, that there will usually be found some cause of constitutional disorder apart from the local inflammation.

The coagulation of blood taken from a person labouring under inflammation takes place more slowly than that of healthy blood; and to this circumstance the formation of the buffy coat has been sometimes ascribed.

The formation of the buffy coat is indeed favoured by slowness of coagulation, and also by the red corpuscles having a greater specific gravity than the fibrin, in consequence of which they sink downwards, and leave the colourless fibrin on their surface. And this downward tendency of the red particles is still further increased in inflammation by their collecting together in rouleaux.

The formation of the buffy coat has been proved by many observations to depend principally upon some vital change in the blood itself, in consequence of which there is an unusual disposition to a separation of the fibrin from the red particles, or, as it has been expressed, "to a sort of repulsion between them." This is exemplified, as was first particularly pointed out by Schrœder van der Kolk, in blood abstracted by venesection during inflammation, and placed so as to form a mere film, so thin as not to permit a stratum of the buffy coat to be over a stratum of red particles; in which case the fibrin and the red particles separate from each other laterally by horizontal movements. This separation is distinct and immediate, and gives rise to a spotted or mottled appearance, which, like the cupped and buffed appearance, is regarded as characteristic of inflammation. By means of the microscope the separation may be beautifully seen in a single drop of inflammatory blood—the red particles becoming aggregated together in the form of rolls, which present an areolar arrangement, and leaving interspaces for the fibrin, "lymph globules," and serum.

There are few facts which the physiologist finds more difficult satisfactorily to account for, than the coagulation of the blood, and the formation of the buffy coat. And hence a great variety of hypotheses have been advanced on this subject.

Hunter came to the conclusion that inflammatory blood has an unusual tendency to separate into its constituent parts, and that it coagulates more slowly than healthy blood, owing to which the red particles have time to subside.

Others have attributed the separation of the fibrin to its lighter specific gravity, and to its excess; whilst others, as already stated, have attributed it to mere slowness of coagulation.

Mr. Wharton Jones, who has carefully employed the microscope in observations on the coagulation of the blood, states, that in inflammation the red particles are diminished, that these bodies have an abnormal adhesive quality by which they aggregate together, and forming a network, squeeze out the liquor sanguinis, which, in virtue of its lower specific gravity, floats on the top.

Such are some of the hypotheses advanced by those who have attempted to explain the coagulation of the blood on vital or physical principles. Dr. Richardson of London, in his Treatise on the Coagulation of the Blood,—a treatise which gained the last Sir Astley Cooper prize,—has offered to the profession a new and startling doctrine, namely, that the coagulation of the blood can be explained on the ground of simple chemical changes; and this conclusion to which he came, he supports by experimental evidence of the most varied and extensive character. Dr. Richardson believes that the fluidity of the blood is owing to the presence of a small quantity of ammonia, which, according to his view, holds the fibrin in solution, and its coagulation is due to the escape of the volatile alkali.

When speaking of the formation of the buffy coat, he remarks that for its production "two conditions are alone sufficient, taken in conjunction with the lower specific gravity of fibrin, as compared with the defibrinated fluid, viz., first, slow coagulation arising from excess of the fibrin solvent (ammonia), or from slow evolution of the solvent, as when dense fluids are added to healthy blood; second, absolute excess of fibrin."

Such is Dr. Richardson's theory of the coagulation of the blood, and of the formation of the buffy coat; and although the experiments and observations of other able men, as Dr. Davies and Mr. Lister, have led them to conclude that it is fallacious, still the opinions of one whose work is so full, and bears evidence of such extended and patient research on the subject it treats of, are highly deserving of much fuller notice than the limits of this work admit of.

TERMINATIONS, RESULTS, OR EVENTS OF INFLAMMATION.

Certain conditions resulting from inflammation were formerly called "terminations of inflammation." But to the use of this expression objections have very properly been made, on the ground that several of the conditions referred to are co-existent states with the inflammation, or successive stages in the progress of the same inflammatory disease, and that the inflammation does not cease or terminate when these conditions occur. The words *results* or *events* are not liable to the same objections, and are now used to denote these conditions. The results of inflammation which we have to consider are, *Resolution—Effusion of Serum—Exudation of coagulable Lymph—Suppuration—Ulceration—Gangrene* and *Sphacelus*.

I. RESOLUTION.

Resolution is said to occur when the symptoms gradually subside, and the liquor sanguinis becomes absorbed, so that no trace of it remains, and the part returns in all respects to its former condition and integrity. There is, in short, a subsidence or resolution of the inflammation; and this result, therefore, may be properly considered a termination of inflammation. The subsidence may be gradual, when the process is called *resolution;* or it may be sudden, without symptoms of inflammation appearing in any other part, when it is called *delitescence;* or it may be sudden and abrupt, and the inflammation may suddenly appear in another part, and then *metastasis* is said to take place.

II. EFFUSION OF SERUM.

The liquid is deposited by exudation through the vascular coats yet entire, and consists principally of the serum of the blood slightly modified, being of higher specific gravity, and containing more albumen than in health, with more or less of fibrinous matter. This result is sometimes seen surrounding an inflamed part, in the centre of which there are other results of inflammation; and then the effusion into the areolar tissue surrounding the part in a higher grade of inflammation constitutes œdema, which is indicated by pitting on pressure. Effusion of serum presents itself in inflammation of serous membranes, as for example, in pleuritis, when the quantity poured out is in some instances very great; and in such cases, if the effusion has taken place rapidly, it will be found, on careful examination, that the supernatant portion is usually clear, and the deeper portion turbid and more dense, owing to the fibrinous portions being of greater specific gravity, and sinking to the bottom. In this instance the blood plasma which exudes, separates into the serum and fibrin. The appearance, however. of the effusion varies according to the acuteness of the inflammatory process. The consequences of serous effusion vary much according to the part affected:—in some situations it is comparatively harmless, while in others, a trifling amount of effusion is sufficient to destroy life.

In every instance of undoubted inflammatory action, exudation of blood plasma takes place; and the fluid, when poured into a cavity, is more or less turbid, and contains generally either a certain amount of fibrin, or some materials capable of transformation into cells. Effusion of pure serum, as an effect of inflammation, is of the rarest occurrence; and is only occasionally found in the very lowest grades of the affection, as in some cases of chronic hydrops articuli, and in some instances of inflammatory œdema of a mucous membrane.

Effusion
pure

Serous effusion is often the result of congestion not inflammatory, and often of venous obstruction unconnected with inflammation; in which cases the fluid is clear, and contains neither fibrin, nor any material capable of becoming organized.

III. EXUDATION OF COAGULABLE LYMPH.

The essential phenomenon, or the pathognomonic effect of inflammation, is the transudation, through the coats of the vessels, of a pellucid fluid called "lymph," "coagulable lymph," "plastic matter," or inflammatory exudation, which, in consequence of an inherent vitality, is capable of spontaneous organization; and, when once poured out on any part, may either become developed into tissue, or may die and be removed from the system.

In inflammatory lymph, two essentially different materials have been found, viz., fibrin and a certain number of bodies to which Dr. H. Bennett gave the designation of plastic, and Lebert, that of pyoid corpuscles; the lymph in which the fibrin preponderates being called fibrinous or plastic, and that in which the corpuscular element is in excess, aplastic, crupous, or corpuscular lymph.

These two kinds of lymph generally occur in the same exudation mass; but the excess of the one variety over the other depends, as Paget observes, on the condition of the blood, the degree of the inflammation, and the character of the tissue involved in the disease.

The fibrinous or plastic variety generally occurs in sthenic, and the corpuscular, aplastic, or croupous variety, in cachectic states of the system.

Again, the greater the amount of fibrin in the exudation, the greater likelihood is there of its organization; whilst the greater the number of corpuscles, the greater likelihood is there of suppuration or degeneration. The first variety generally passing into fibrous formations, and the second into pus corpuscles, granule cells, and granules.

The characters of cancerous and tuberculous exudations will be described in a subsequent part of the work.

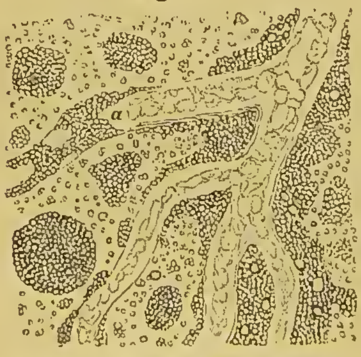
The form in which healthy, simple exudation is deposited, and the manner in which it becomes developed, differ considerably according as it takes place in a serous or mucous membrane, or is poured out into the parenchyma of an organ, or after a wound or injury.

In inflammation of serous membranes, the appearances presented by the coagulable lymph vary according as the inflammation has been more or less acute; and in instances where it has been decidedly acute, according as it has been found more or less rapidly fatal.

The coagulable lymph at the earliest period, and while it presents the gelatinous semitransparent appearance, seems to consist of filaments formed of minute molecules, precipitated in a linear arrangement.

As the lymph becomes firm, it appears to consist of the same filaments, larger in size, having a less molecular appearance, varying from the $\frac{1}{14,000}$ to $\frac{1}{10,000}$ of an inch in diameter, frequently interwoven with one another, and ultimately bearing much resemblance to those observed in dense fibrous tissue. Interspersed among these fibres may be observed numerous transparent corpuscles, which, after a time, become more distinct, and are seen to consist of a cell-wall enclosing from three to eight granules. To these bodies, as already stated, the name of plastic corpuscles was given by their discoverer, according to whom they vary in size from $\frac{1}{1300}$ to $\frac{1}{3000}$; and their enclosed granules from $\frac{1}{34,000}$ to $\frac{1}{10,000}$ of an inch in diameter.

Fig. 3.



Granules and granular masses, filling up the intervascular spaces, and coating the vessel at *a*. The transparent nuclei may be seen here and there among the granules. Example of intervascular deposit.—Bennett.

The further changes which the lymph undergoes in the progress of its development are the following: the corpuscles gradually disappear, though some of them remain, constituting, as observed by Dr. Drummond, permanent nuclei among the fibres; the surface of the exudation becomes a mass of vascular absorbing villi; the fluid part of the plasma is gradually taken up by the vessels of the villi;

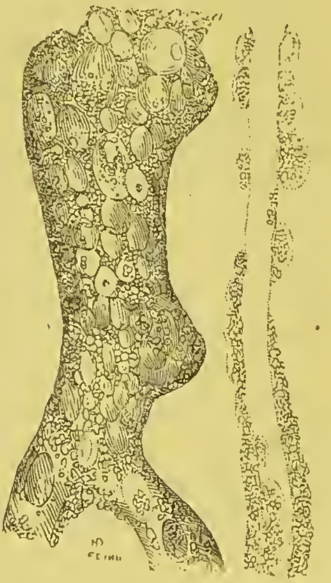
Where
Manner

and ultimately the two vascular surfaces closely adhere together,—this result constituting what is called adhesive inflammation, or the adhesive stage of inflammation.

When lymph is exuded on a mucous membrane, it most frequently degenerates into a yellowish fluid termed pus, consisting of certain characteristic corpuscles floating in an albuminous liquid; but occasionally it forms a fibrous mass of low vitality, as in croup. The characters of pus corpuscles will be afterwards described under the head of Suppuration.

Again, where the coagulable lymph is poured out in the parenchyma of an organ where there is much mucous tissue, it is usually transformed into pus; but in organs where such a membrane does not exist, as in the brain, it is deposited in the form of minute granules varying from $\frac{1}{12,000}$ to $\frac{1}{6000}$ of an inch in diameter, and both coating the exterior of the vessels and filling up the intervals between them. Lying here and there among the granules may be seen several transparent globules, supposed to be the liberated nuclei of cells, which are often seen in the exudation, either partially or wholly filled with fatty granules, and, when fully formed, averaging from $\frac{1}{1000}$ to $\frac{1}{750}$ of an inch in diameter.

Fig. 4.



Two vessels coated with granules, nuclei, and compound granular corpuscles. Example of exudation.—BENNETT.

Again, in the case of granulating wounds or sores, we find that the little prominences or granulations, as they are termed, are formed of a mass of cells piled one over the other without any apparent order; that they present many varieties of shape; and that ultimately they are developed into fibro-cellular tissue. This conversion of the cells into fibrous tissue commences at the base of the granulations; and while these changes are going on there, the cells on the surface of the prominence are either thrown off in a rudimentary form, or degenerate into pus corpuscles. But as the fibrous formation in the deeper layers increases, the amount of purulent discharge diminishes, and ultimately ceases, the whole remaining exudation passing into a fibrous formation

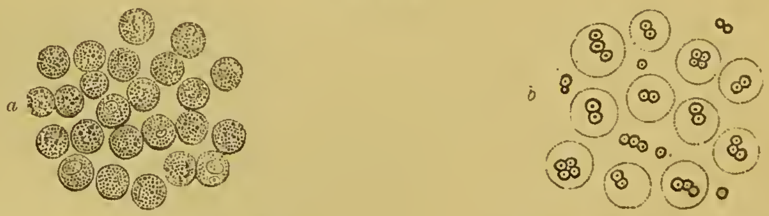
Different opinions have been advanced as to the mode in which new vessels are formed in exudations. Some think that blood corpuscles escape from the original vessels adjacent, and hollow out for themselves channels in the plasma, and that these are, by and by, succeeded by others in a continuous stream. Others have given it as their opinion, that bulgings or irregularities appear on the sides of the original vessels adjacent, and that these bulgings or irregularities become projected, as it were, into new channels by the *vis a tergo.* A third view, which some recent inquirers on this point corroborate, is that, in exudations, new vessels arise from independent cells, just as they do in the embryo, although the original vessels in the tissues adjacent to the exudation may occasionally send out offshoots from their walls. These cells arrange themselves in lines, and communicate by decadence of their opposing walls; and the vessels, thus formed, afterwards connect themselves with the old vessels.

IV. SUPPURATION.

This term is used to denote the transformation of the exuded matter into pus, a result most commonly found in cellular tissue, constituting an abscess, on the surface of granulating sores, and on the mucous membranes. Normal pus, such as that formed in phlegmonous abscess, or that yielded by healthy granulating sores, is an opaque, creamy, straw-coloured, or slightly greenish fluid, having a peculiar mawkish odour, which it loses on cooling, and a sp. gr. of 1030—1033. On examination of its minute structure, it is found to consist essentially of two distinct parts—numerous minute organized particles, called pus-corpuscles, and a clear yellowish liquid named the liquor puris, in which the corpuscles are suspended.

The form of the pus-corpuscles in genuine pus, is perfectly spherical, with a finely granulated surface; they vary in size from 1-100th to 1-75th of a millimetre in diameter; and in proportion as the pus deviates from the normal type, varieties are observed both in the form and size of the globules. When the corpuscles are examined in heaps, they exhibit a yellow tint; but when separately, they appear colourless. They are organized forms, and consist of a nucleus, cell-wall, and contents. The nucleus is for the most part composed of several granules, generally two or three, but sometimes four or five, and is hence called a composite *multiple* nucleus. It is not placed in the centre of the cell, and is usually attached to its inner surface.

Fig. 5.



a. Pus-corpuscles, as seen in healthy pus. *b.* The same, after addition of acetic acid.

On the addition of water, the pus-corpuscles become increased in size, and more transparent, and usually lose their finely granulated surface. Both weak and strong acetic acid dissolve the cell-wall, the one partially, the other completely; and by that means the nucleus can be brought clearly into view.

Pus is termed sanious, when it is of a reddish colour from admixture of blood; ichorous, when the corpuscles are few in number, and the fluid they float in is thin and acrid; grumous, when containing clots of blood; curdy, when cheesy-like flakes are seen floating in it; and when mixed up with serum or pus, it is often called sero-pus, or muco-pus.

The characters of scrofulous pus will be described under the head of Tubercle.

The liquor puris, or fluid in which the pus-corpuscles float, resembles both in its chemical and its physical characters the serum of the blood, and is composed of water, albumen, fat, extractive matters, and various salts.

The tendency of inflammation to run on to suppuration, is determined, in a good measure, by the character and the degree of the inflammation itself, by the constitution of the patient, and by the nature and local conditions of the part affected. Thus, inflammations of an unhealthy character, or of great intensity, occurring in a weak subject, or inflammations of mucous membranes, or parts exposed to the action of the air, are more likely to terminate in suppuration, than a moderate degree of inflammation occurring in a healthy robust subject, or than inflammations of serous or fibrous tissues, or of parts protected from the influence of the atmosphere.

The pus-corpuscles may be formed either from fluid cyto-blastema, as in the fluid secretion of fresh wounds, in suppuration on the surface of the body after burns or blisters, and in suppurations on mucous membranes, as in catarrhs and gonorrhœa; or from a solid cyto-blastema of fibrin after coagulation:—in other words, pus may be formed from fluid blood-plasma before coagulation, and also from exuded matter rendered solid. On the formation from fluid cyto-blastema, Vogel remarks:—"The process of the formation of pus from a fluid cyto-blastema can be best observed in fresh wounds cleansed from blood. In examining the fluid secretion from a wound, we first observe minute granules, less than the 1000th of a line in diameter, which are chemically identical with the molecules insoluble in the alkalies and in borax. There then appear, partly around these molecules and partly independent of them, somewhat larger corpuscles, soluble in the alkalies but not in acetic acid, identical with the nuclei of the pus-corpuscles. These nuclei appear sometimes isolated, sometimes in groups of twos or threes, thus forming corporate nuclei; around these the cell-wall is subsequently developed; first appearing as a pale transparent membrane, and subsequently becoming thickened and granular; and thus the pus-corpuscle is formed. The production of pus-corpuscles in this manner is tolerably rapid; in the course of three or four hours after the first appearance of the nuclei perfect corpuscles may frequently be seen: in other cases the process is slower." The formation of pus-corpuscles from a solid cyto-blastema of coagulated fibrin is a process of frequent occurrence, as, for example, in abscesses in which the coagulated fibrin is changed into fluid pus, in cases in which pus is formed from the solid exudations from serous membranes, and in numerous other instances where a solid blastema is rendered fluid by the formation of pus. After the formation of the pus-corpuscles, the fibrin of the cyto-blastema is exhausted, and the serum of the pus resembles greatly the serum of the blood. Pus-corpuscles are incapable of passing into permanent structures, or of undergoing a higher development, or of conversion into a more perfect organism.

When purulent matter is confined in the parenchyma of a part, in a cavity which is not natural, it constitutes an abscess; when infiltrated through the structures of an organ, the condition is termed purulent infiltration; when the purulent matter is formed on a mucous membrane, from which it is voided externally, the patient is said to have a purulent discharge; and when the matter forms an accumulation in some regular and natural cavity, the case is said to be one of purulent effusion, or of suppuration in that cavity.

Abscesses may be either acute or chronic.

ACUTE ABSCESS.

Symptoms.—When inflammation is about to lead to the formation of abscess, the symptoms which at first are the usual local and constitutional symptoms of inflammation, undergo a degree of aggravation. In many instances, however, the suppuration does not proceed so far as to produce sympathetic inflammatory fever. The pain becomes of a distressing pulsatory character, and often after the formation of matter changes into an uneasy feeling of weight, or of heaviness and pressure; redness and tension, after being very great, are diminished, and the swelling, on being examined, presents different characters at different stages of the inflammation, being at first tense and hard in the middle, and œdematous around, and afterwards soft in the centre, hard at the circumference, and œdematous at a still greater distance from the centre of inflammation. When the swelling becomes elevated and prominent at one part, it constitutes the condition technically called the pointing of the abscess. In general, some time before the abscess points, fluctuation is discoverable; and this, taken in conjunction with the other symptoms, is one of the surest signs of the presence of matter, as it can only exist when there is fluid. At an early stage, however, when the superimposed structures are still thick and tense, and the quantity of matter but scanty, the perception of fluid is obscure; but it becomes more and more distinct, as the textures intervening between the abscess and the surface of the body become thinner. To discover whether fluctuation be present, the fingers may be pressed alternately on the swelling; or (which is preferable) the fingers of one hand may be applied to one side of the swelling, while, with the fingers of the other, the opposite side is tapped, and the undulations of the pus will be distinctly perceived. Some surgeons greatly excel others in detecting the presence of matter. This skill is of great importance, and every surgeon should endeavour to acquire it in the greatest possible degree.

The *tactus eruditus*, as it is called, may be acquired by any one who has experience, and acuteness of the sense of touch, together with the valuable talent of using them aright. When suppuration is deeply seated, so that fluctuation and pointing are not discernible, there are other symptoms which afford pretty certain evidence of the formation of matter, provided the inflammation be to a considerable extent: — these are shiverings, technically called rigors, before the suppuration occurs; and after it has taken place, a change from the acute pain in the part to a feeling of weight, or numbness, or pressure, or some sensations totally different from those experienced during the acute inflammation. Antecedently to suppuration, there is frequently interruption of the proper performance of the function of some organ; and if the abscess be deeply seated and large, the pulse ere long becomes feeble and increases in frequency; the patient becomes emaciated, and the constitutional symptoms are rapidly changed from those of inflammation to those of hectic fever.

The condition of the parts.—The condition of the parts in acute abscess may be stated to be :—suppuration, where fluctuation is perceptible; deposition of fibrin around the pus, offering a barrier to infiltration of pus into the surrounding textures, and constituting the hardness at the circumference; and serous effusion into the parts external to the barrier of fibrin, giving rise to œdema, evidenced by pitting on pressure.

Treatment.—To remove general and local causes of excitement and irritation, and to promote the approach of the matter toward the surface, are important indications in the treatment of abscess. The best means of fulfilling these indications are, the strict observance of antiphlogistic regimen, perfect rest of the affected part, strict maintenance of a proper attitude, the removal of all sources of irritation, as well as of tension or pressure, and the diligent use of warm emollient poultices, followed by hot fomentations.

Purulent matter having once been formed, it may be stated as a general rule in the treatment of acute abscess, that the grand indication then to be fulfilled is the early and free discharge of the matter. In some circumstances very early attention to this rule is of the utmost importance; as in abscesses under dense aponeuroses, and under thick fasciæ; for example, under the temporal aponeurosis, the tendon of the occipito-frontalis muscle, the fascia of the thigh, of the leg, of the arm, or of the fore-arm, or under the palmar or plantar fasciæ — in abscesses within tendinous sheaths, as in paronychia tendinosa, or underneath the periosteum, as in paronychia periostei, or under the pericranium, in the proximity of bones, in the natural cavities, or in the texture of bones—also in abscesses arising from the extravasation of irritating fluids, as collections of matter caused by the extravasation of urine into the cellular tissue of the perineum and scrotum—in abscesses in parts abounding with cellular tissue, when there is great risk of the spreading of the inflammation, or in situations where there is danger of making their way into some of the natural cavities, as into the chest, or abdomen, or the joints; or such as are likely to occasion injury by pressing upon or impeding the functions of important parts, as the trachea, the pharynx, the urethra—or in abscesses in higher vascular and sensitive parts, where the pain of an abscess is often most excruciating. With scarcely more than one exception, early and free opening of an abscess is the proper course: but in the above-mentioned conditions, it is peculiarly necessary, so soon as we are certain of the actual existence of matter: for not only are time and suffering saved, and tissue preserved by its adoption; but by its neglect the danger of most destructive local results is increased, and in some circumstances, even the loss of life itself may result. Almost the only condition in which it is proper to delay opening is, in cases of glandular enlargement, in which, when other means have failed to produce absorption, and suppuration has occurred, the opening should be deferred, that the pressure of the matter may more effectually secure the disintegration and breaking up of the glandular structure, and thereby favour its removal.

Of the various methods of opening abscesses I shall refer to two only; namely, by means of a bistoury, and by means of caustic. The former is preferable, except in two conditions, presently to be mentioned. It consists in making a *free, direct* opening in a depending situation, and, as already stated, at an early period. In the event of the matter making its way in a different direction, a second opening should be made, which, from being often opposite to the first, is called a counter-opening. By making an early, large, direct opening in a depending situation, and keeping it open while matter continues to be secreted, the formation of sinuses, loss of substance, and disintegration, are generally prevented; and the desired result is attained more speedily, and with less suffering than it would be by any other proceeding.

The two conditions in which opening by means of caustic is preferable are the following:—

1. In small abscesses, partaking of a chronic character, where the integuments are attenuated in consequence of the opening having

been delayed, or where they are in a diseased state. In such cases the integuments are too much weakened to take on the necessary action for uniting with the subjacent parts; and as no healing process takes place until they are destroyed by ulceration, it is better to destroy them at once, and make a free opening by means of caustic. For this purpose the potassa fusa is preferred, and is applied so as to destroy the whole of the diseased and thinned integument.

2. In cases of glandular enlargement in the state of abscess; in which condition the caustic should be used very freely, and be pressed into the gland in different situations, so as to lead to the action by which the diseased structure may be separated and removed.

CHRONIC ABSCESSES.

Collections of matter sometimes form slowly and insidiously, and the symptoms of inflammation which precede them, are but slightly, if at all, perceptible. In such cases, the abscesses are said to be chronic. These collections often attain a great size; there being little fibrin effused around the matter, the sac is thin, and the resistance to extension feeble; they are frequently irregular in form, and the superimposed skin remains unaltered in colour.

The treatment of chronic abscess is a matter of great anxiety to the intelligent surgeon, in consequence of the danger, lest the opening of the sac should be followed by violent irritative fever, which has a tendency to merge very speedily into hectic fever. Where such collections are small, the patient's health tolerably good, and his constitution not very susceptible of inflammatory action, the treatment proper for acute abscesses, namely, free, direct incision, may be ventured upon; but as the danger of this proceeding is considerable, the surgeon is justified in resorting to it only under the conditions mentioned above. In all other cases, the treatment should consist in drawing off the matter by small valvular tapping—in closing up the wound so as to prevent the admission of air, by the presence of which the opposite sides of the sac would be separated from each other, the putrefaction of the remaining matter promoted, and much constitutional disturbance induced,—in preserving the sides of the sac in contact, by gentle support,—and in renewing the valvular opening, before any great re-accumulation has taken place, so that the sac may not be allowed to regain anything like its former size, each opening being made with the observance of the same precautions as in the first instance. Sometimes, although very rarely, after the first operation the cavity contracts, and the desired result is obtained; but more frequently several repetitions of the operation are required before the disease is cured; and in some instances, after the sac has become very much contracted by the adoption of the above procedure, it becomes safe to resort to the treatment for acute abscess, namely, free, direct incision, in order to perfect the cure. The best apparatus for this mode of treatment, consists of a long trocar, a canula furnished with a stop-cock, and a fine exhausting syringe which fits the canula. About an inch-and-a-half or two inches from the spot where the sac is to be opened, a small aperture should be made in the skin; through this the trocar is to be inserted, carried under the skin, and sent through the sac where it is to be opened; the trocar should be withdrawn, the stop-cock being shut before it is completely removed; the syringe should be applied to the canula, and the matter drawn off, care being taken to shut the stop-cock after each stroke of the syringe. Gentle pressure should be applied to the sac, and while the canula is being withdrawn, pressure should be applied over its track, to prevent the admission of air; the opening should be closed up very carefully by means of plaster, and preserved close, until adhesions have taken place. Rest, and every judicious precaution should be strictly enjoined, for some time after each operation, to diminish the danger of inflammation of the sac. This treatment is, in my opinion, the safest that has yet been proposed for this form of abscess, and by means of it, a favourable result is occasionally obtained. But in many instances, these abscesses are connected with incurable diseases of the bones or joints; and as, in such cases, patients live much longer when the abscesses are not opened, there can be no doubt whatever that, under these circumstances, it is the duty of the surgeon to let them alone.

V. ULCERATION.

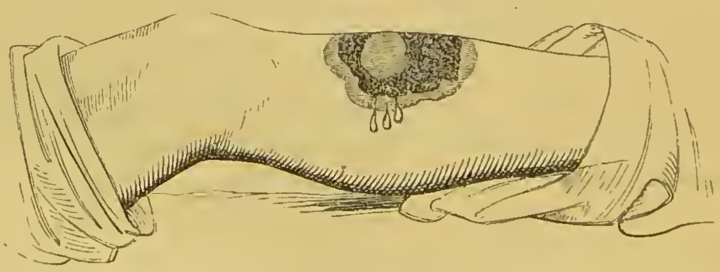
This is a frequent result of inflammation. Great differences are observed in the different tissues, with respect to their tendency to ulceration, when they become affected with inflammation; and these differences have important pathological bearings. It is most common in the skin, mucous membranes, cellular tissue, and the other tegumentary membranes; it is frequently met with in bones, and the inner coats of arteries: but is very rare in fibrous tissues of all kinds, in serous membranes, in the outer coats of arteries, and in nervous tissue. The process of ulceration, according to the views now entertained, is very clearly explained in the following quotation from Dr. Bennett's admirable "Treatise on Inflammation:"—"The process of ulceration is somewhat similar to that of mortification, only it is more chronic, and the exudation, instead of undergoing decomposition, only exhibits an indisposition to pass into organization. In this case, the exudation is poured out slowly, it coagulates, and presses upon the surrounding parts, more or less obstructing the flow of blood to them, and acts as a foreign body. By means of the continued pressure, the circulation is obstructed, and death of tho portion affected results. Sometimes this is imprisoned in fresh exudation, as ulceration extends, and the whole at length becomes disintegrated. All this time the exudation exhibits little of that tendency so conspicuous in healthy persons, to undergo changes in itself, and when examined microscopically is found to consist principally of very minute granules, varying in size from the $\frac{1}{12,000}$ to the $\frac{1}{500}$ of a millimetre in diameter. These are occasionally mixed with irregularly formed cells, usually more or less angular, containing one or more granules. The cells are more numerous, in proportion to the stage of the ulceration and the healthy powers of the constitution. These different granules and imperfect cells, with the structures they involve, at length become broken down, and separate from each other, constituting a semi-fluid mass, which has a tendency to point where it can most readily be discharged, that is, towards the surface of the skin or mucous membranes. Here, on account of the less degree of resistance offered, the continued pressure and disintegration of tissue first cause an aperture to be formed. Another portion of solid exudation is now broken down with the tissues involved in it, and in this way the opening is enlarged. If the morbid process continue, a fresh exudation is slowly poured out below the already coagulated blood-plasma, which supplies the loss thrown off in the form of discharge, and thus chronic ulceration may be increased indefinitely. The whole of this process may be well observed in scrofulous and syphilitic ulcers, or in the callous sores of the leg in weavers, and others of a cachectic constitution. Indeed, the general powers of the constitution are almost always in such cases enfeebled, and hence the indisposition of the exudation to be transformed into organized cells. Ulcers produced by direct pressure are occasioned in a similar manner; only in most cases the pressure is not derived in the first instance from solid exudation poured out. Thus in stumps, not sufficiently covered by soft parts, in places long pressed upon by lying, or by the growth of tumours, the vitality of the part is slowly destroyed. At the same time an exudation is poured out from the neighbouring vessels, which becomes broken up, and assists in disintegrating the textures, whose vitality is destroyed. The finely molecular particles are thus absorbed, whilst the grosser portions are thrown off in the form of discharge."

From all ulcerous surfaces there is a certain amount of discharge, which varies in character according as the sore is healthy, indolent, gangrenous, &c., as will be afterwards specified in the description of the several varieties of Ulcers.

Granulation.—The process by which the cavity is filled up, and continuity of tissue restored, is called granulation: it consists, as stated before, in exudation, from the surface of the cavity, of blood-plasma, constituting the fluid cyto-blastema. Part of this blood-plasma degenerates into pus-corpuscles, but part becomes transformed into nucleated cells. Minute granules, forming the nucleoli, as they are called, are developed, and to the assemblage of these the term nucleus is given. On the nucleus a cell-wall becomes developed, which, at first closely embracing the nucleus, is afterwards raised up from it; and the nucleus thus separated from the cell-wall occupies an eccentric position within it. In these organized products vessels are formed; and the whole, when thus developed, constitutes a layer of granulations spreading over the surface of the cavity, and giving it the appearance of being covered with innumerable small bodies of a conical form, and of a florid red colour. From the granulations blood-plasma is exuded, part of which degenerates into purulent matter for the defence of the granulations; and part is transformed into nucleated cells, by which a new layer of granulations is formed. The cells of the first-formed layer undergo further changes, and are ultimately developed into the texture of the part, from the vessels of which the exudation of blood-plasma took place; and each subsequent exudation furnishes a cyto-blastema for the formation of purulent matter and nucleated cells. By the successive formation of these cells, by their becoming ultimately developed into permanent tissue, and by the centripetal contraction of the original textures, the cavity is filled up; and the next part of the process is *cicatrization*, or the formation of cicatrix. This usually begins, when the granulations arrive on a level with the surrounding skin, when the blood-plasma, hitherto converted partly into pus-corpuscles, and partly into nucleated cells, passes into cells which, by the process of development, are converted into fibres, and constitute the cicatrix.

The new skin usually takes its rise from the margins of the old skin; but in some few instances, portions of new skin are seen forming on the surface of the granulations, like little islands, quite remote from the margins. Some have endeavoured to account for this fact, by the supposition that the old skin had not been completely destroyed, as we not unfrequently find in burns, and that the isolated portions of the new skin spring from the parts not entirely destroyed by the burn or ulceration; but I am convinced by various cases which have come under my own observation, that this explanation is not satisfactory. I shall only refer to one case, that of a young lady, whom I had the opportunity of seeing, together with one of my colleagues in the University. The lady was the subject of phagedænic ulcer in the leg, of considerable size and of great depth; and as other means had had no effect in arresting the destructive action,

Fig. 6.



the whole surface was destroyed to a considerable depth by pure nitric acid. After the removal of the slough, healthy action took place, and a large isolated portion of skin formed in the middle, and gradually increased until it joined that formed from the circumference of the ulcer. I have for several years been in the habit of showing to my class in the University a drawing of this case, as it is an incontrovertible instance of an exception to the ordinary rule of the formation of skin from the circumference only, and an evidence that the explanation mentioned above is not satisfactory.

ULCERS.

An ulcer may be defined—a solution of continuity caused by ulceration. Future chapters will give a description of specific ulcers, that is, ulcers caused by a specific poison, as syphilitic ulcers, and those connected with particular diatheses, such as the scrofulous, the scorbutic, or the cancerous. Other ulcers, not coming under either of these divisions, we shall, for the sake of clearness, arrange into seven varieties, namely :—1st, healthy ulcer ; 2nd, weak ulcer ; 3rd, indolent ulcer ; 4th, inflamed ulcer ; 5th, phagedænic ulcer ; 6th, gangrenous or sloughing ulcer ; and 7th, sloughing phagedæna.

In describing the appearances of ulcers, we shall refer to the state of the edges, the granulations, and the discharge.

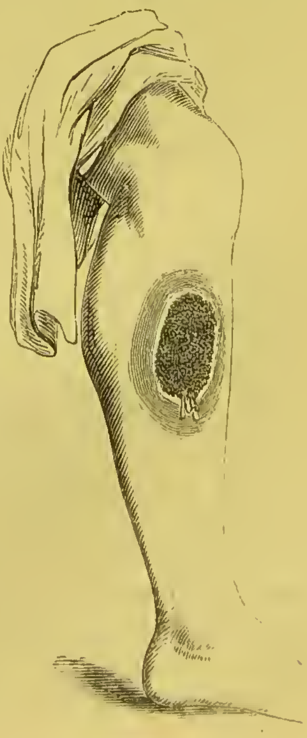
I. HEALTHY ULCER.

The healthy ulcer, the simple, and the simple purulent, are different names given to the same ulcer.

Characters of a healthy ulcer. — The edges are smooth, neither inverted nor everted, and adhere to the granulations; and when the latter rise to a level with the common integument, a semi-transparent white film of cicatrix fringes round the edges, and gradually spreads over the granulations. The granulations are small, florid, firm, numerous, and pointed at the top, vascular, apt to bleed on being touched, sensitive, and attended with a slight feeling of tenderness, instead of uneasiness or pain. When the granulations come to be on a level with the integument, they begin to be covered over by cicatrix. The discharge is thick and purulent, and easily separated from the surface of the sore.

Treatment.—The treatment consists in preserving the part at rest, in maintaining

Fig. 7.

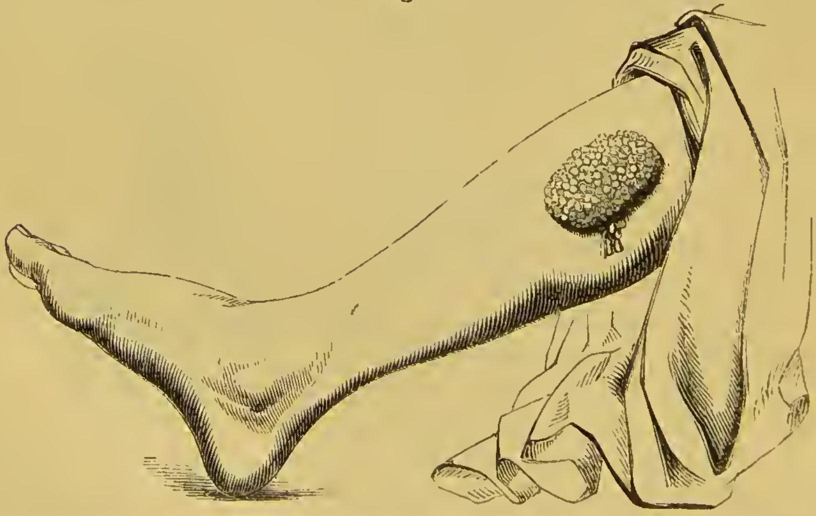


such an attitude as will promote venous return and prevent unpleasant sensations and consequences from tension, and in defending the part from the action of the air. Of the various means adopted for fulfilling this last-mentioned indication, the most elegant is tepid water-dressing, applied by means of a small piece of lint, with a piece of oiled silk over it to prevent the lint from becoming dry. The frequency of the dressing will depend on the quantity of the discharge; it being necessary only in order to preserve the parts perfectly clean and comfortable. Another application still employed by some is simple ointment; but, for my own part, I almost invariably, like many others, give the preference to the tepid water-dressing, with a small piece of oiled silk, and a few turns of a bandage to afford gentle support when necessary.

II. WEAK ULCER.

Characters.—In the weak ulcer, called by many writers the fungous ulcer, the granulations, instead of being like those described in the characters of the healthy ulcer, are much larger, paler, flabby, less numerous, not pointed on the top, but, on the contrary, sometimes even bulbous, less vascular, less apt to bleed on being touched, less sensitive, unattended with pain, and when they have filled up the cavity of the ulcer, rise above the level of the surrounding integument, so that the margins are sometimes at this stage overlaid by them, and concealed from view. The edges are smooth, and the discharge is pale, and thinner than in healthy ulcer.

Fig. 8.



Treatment.—A necessary part of the proper treatment consists in removing, if possible, the cause; and, in addition to this, suitable means are to be adopted for removing the effects. The cause of the ulcer assuming the characters above described may be *general*, operating on the system at large; such as, a deficiency in the quantity or nutritive quality of food, an unwholesome atmosphere, a weak or disordered condition of the digestive apparatus, the debilitating effects of mental anxiety, or feebleness of constitution, however induced. Or it may be *local*, such as improper treatment; as, for example, the use of relaxing applications, venous congestion caused by some obstacle to the return of the blood, or a weakened condition of the parts occasioned by the nature of the injury of which the ulcer is the result, or the delay of cicatrization; for perfectly healthy granulations become weak when healing is by any cause delayed. With regard to local treatment, rest should be enjoined, and an attitude favourable to venous return, together with the careful application of gentle pressure by uniform bandaging, which acts as a gentle stimulant to the granulations, and corrects the tendency to passive congestion. The use of a medicated water-dressing of a stimulant nature, instead of plain tepid water-dressing, should also be adopted. Solutions of the sulphate of zinc, or the sulphate of copper, varying in strength from one to two grains, or even more, to an ounce of water, generally answer most satisfactorily in the treatment of this ulcer. I usually prefer the solution of the sulphate of zinc, either the simple solution, or medicated with two drachms of the compound spirit of lavender and a drachm of the spirit of rosemary to eight ounces of water. The lotion should be kept applied by means of a little lint, with a piece of oiled silk placed over it to prevent drying; and at the same time bandaging should be employed, not merely as in healthy ulcer for retentive purposes, but to secure gentle and uniform pressure.

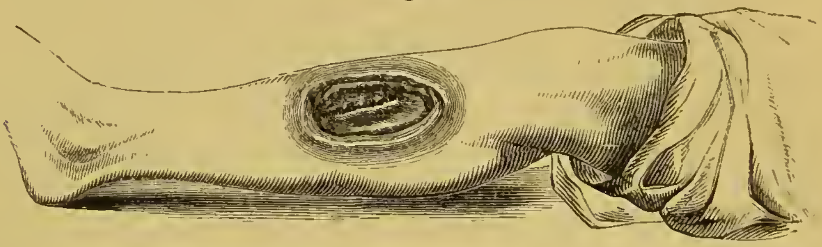
Other modes of treatment which have been adopted are, pressure together with the application of dry lint to the granulations as a dressing, shaving off the fungous granulations with a knife, and destruction of them by escharotics. The treatment already described will very rarely be found to fail in producing the desired effect; but when it does fail, recourse may for a short time be had with advantage to pressure, with a dressing of dry lint.

III. INDOLENT ULCER.

Characters.—The form of this ulcer is seldom irregular, but usually nearly oval or circular. The edges are thick, prominent, comparatively insensible, glossy, smooth, firm, incompressible, and without any appearance of cicatrix; the surrounding parts are also firm, hard, incompressible, and usually discoloured by passive congestion; the surface of the ulcer is nearly devoid of granulations, is smooth and glossy, and varies in colour, being in some examples whitish, in some grey, and in others brownish. The discharge is scanty, thin, and watery. This ulcer may be said to be almost exclusively confined to the labouring poor, occurring in their lower extremities, and after the middle period of life.

Treatment.—An important indication, as may readily be imagined in the treatment of this ulcer is, to improve and maintain the general health and strength; and with this view, generous diet, residence in an airy situation, and the due regulation of the digestive organs should be prescribed, together with the use of tonics in many instances, and even of stimulants, when indicated by the particular circumstances of the case. Of many different modes of treatment I shall refer only to two, namely, that suggested by Mr. Baynton, and that by Professor Syme. Of these the former has hitherto been generally regarded with favour, and has received the general adoption of the profession. When it is carefully conducted, its results are very satisfactory. The following is Mr. Baynton's description of his method of treatment:—"The parts should be first cleared of the hair, that none of the discharges, by being retained, may become acrid and inflame the skin, and that the dressings may be removed with ease at each time of their renewal, which, in some cases, when the discharges are profuse and the ulcers very irritable, may perhaps be necessary twice in twenty-four hours, but which I have in every instance been only under the necessity of performing once in that time. The plaster is to be cut into slips about two inches in breadth, and of a length that will, after being passed round the limb, leave an end of about four or five inches. The middle of the piece, so prepared, is to be applied to the sound part of the limb, opposite to the inferior part of the ulcer, so that the lower edge of the plaster may be placed about an inch below the lower part of the sore, and the ends drawn over the ulcer with as much gradual extension as the patient can well bear; other slips are to be secured in the same way, each above and in contact with another, until the whole surface of the sore and the limb is completely covered at least one inch below and two above the diseased part. The whole of the leg should then be equally defended with pieces of soft calico, three or four times doubled, and a bandage of the same, about three inches in breadth and four or five yards in length, or rather, as much as will be sufficient to support the limb from the toes to the knee, should be applied as smoothly as can possibly be performed by the surgeon, and with as much firmness as can be borne by the patient. It is to be first passed round the leg at the ankle joint, then as many times round the foot as will cover and support every part of it except the toes, and afterwards up the

Fig. 9.



limb till it reaches the knee; observing that each turn of the bandage should leave its lower edge so placed as to be about an inch above the lower edge of the fold below it." The success of this method of treatment, when applied in suitable circumstances, is generally acknowledged. Callous ulcers are often presented for treatment in an inflamed state; soothing applications should in such circumstances be prescribed, until that condition be removed, and then the treatment above described may with propriety be resorted to. One great advantage of this method of treatment is, that perfect rest and constant elevation of the limb are not so essential auxiliaries as in other methods; and this is, in some circumstances, a matter of great importance. The good effects of this mode of treatment are properly ascribed to pressure, which, by promoting absorption of the swelling, favours the contraction requisite for cicatrization. The merit of first pointing out the beneficial effects of pressure in the treatment of this ulcer is due to Mr. Whateley, who applied pressure by bandages alone; that of prescribing adhesive plaster, together with the use of a bandage, belongs to Mr. Baynton.

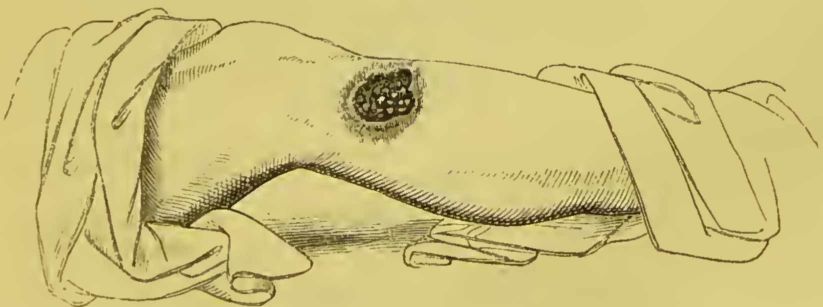
Syme

Professor Syme's treatment consists in the application of a blister, sufficiently large to cover the ulcer and a portion of the surrounding parts. In favour of this mode it is urged, that it is more speedy and more economical than Baynton's; but as the risk of erysipelas is considerable, and as the first effect is to enlarge the ulcer, a result far from desirable, although it may improve its character, it has always appeared to me, that as a general practice, the method of Baynton is to be preferred: at the same time, however, I am perfectly aware that satisfactory results are often obtained by the adoption of that of Syme.

IV. INFLAMED ULCER.

Characters.—The edges and surrounding parts are red, swollen, hot, tense, tender, and painful; the surface of the sore is destitute of granulations, and presents a raw and pulpy, or a foul and livid appearance; the discharge is profuse, offensive, and often streaked with blood, mingled with ulcerative debris. The pain is great, and there is always more or less constitutional disturbance.

Fig. 10.



Treatment.—The object aimed at in the first instance being the conversion of the inflamed, into a simple, healthy ulcer, undue irritability and excessive action must be first subdued; and for this purpose, general as well as local treatment must be instituted. The diet should be carefully regulated, and the secretions of the digestive organs and of the skin brought into a proper state by purging, antimonials, calomel, and opium, or such other remedies as seem to be indicated by the particular circumstances of the case. With regard to local treatment, perfect rest, the observance of an attitude calculated to promote venous return and relaxation, are absolutely indispensable. Of local applications, the most useful are warm poultices and fomentations, or opiate poultices, and opiate fomentations; in short, heat with moisture, or heat and moisture combined with opiate applications, are the most soothing remedies. Simple poultices, or poultices medicated with decoction of opium, are very useful and grateful in such cases. Local depletion by leeches, or scarification of the edges of the ulcer is sometimes resorted to; but it is very seldom that such a proceeding is necessary.

V. VI. VII. PHAGEDÆNIC ULCER.—GANGRENOUS ULCER.—SLOUGHING PHAGEDÆNIC ULCER.

The characters and treatment of the phagedænic and the gangrenous ulcers, and of sloughing phagedæna will be minutely described in the chapter on the state of constitution in which they are most frequently observed; but their characters may be briefly stated in this chapter. The three varieties—namely, phagedæna or phagedænic sore, sloughing or gangrenous sore, and sloughing phagedæna, called by some writers the phagedæna gangrenosa, are so similar to each other in the circumstances in which they are found, in their symptoms, and in their treatment, that it will be more con-

Fig 11.

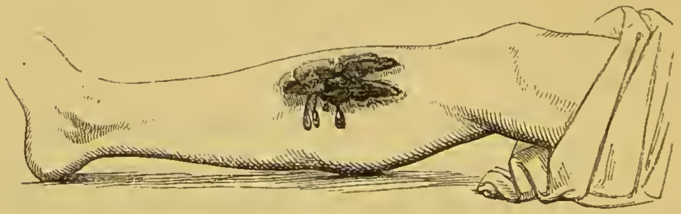
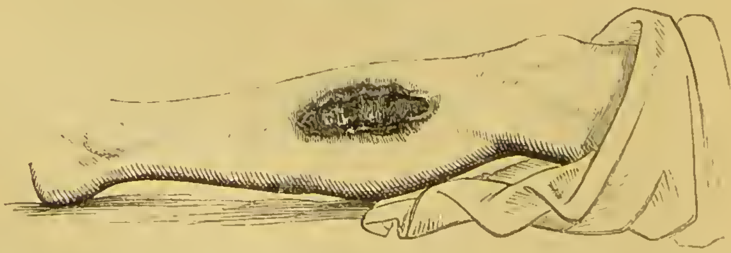


Fig. 12.



venient to describe them together than to assign a separate section to each. The term phagedæna, derived from φάγω, to eat, is well applied to this kind of ulcer, as there is the appearance of regular eating away, or destruction by phagedænic ulceration, without any attempt at granulation.

Phagedæna, or a phagedænic ulcer, may be distinguished by the following peculiarities:—The edges are extremely irregular, and of a dark purplish appearance, a red colour extending a considerable way into the surrounding parts; they are exceedingly painful, and at parts inverted; the surface of the sore is uneven, and extends underneath the edges; it is of a livid or dark red colour, and, together with the edges, has a very irritable appearance. It is covered with a thin ichorous bloody discharge. The sore enlarges with alarming rapidity; and the destructive process may continue to be carried on by ulceration alone, or by ulceration together with sloughing, so as to constitute the variety called by some writers the sloughing phagedæna, and by others the phagedæna gangrenosa. In the other variety, namely, the sloughing sore, the destruction is by sloughing alone; the sore enlarges by the formation of one slough after another, and the surface of the sore, on the separation of the slough, has a raw red irritable appearance. These three varieties exhibit the same appearance of edges, and occur in similar circumstances; they differ chiefly in the appearance of the surface of the sore, there being in the phagedænic sore an irregular appearance of the surface, occasioned by the ulcerative process; in the sloughing phagedæna the same appearance at some parts, and a wet ash-coloured slough at others; and in the sloughing variety a wet slough covering the sore. The characters of these ulcers are so peculiar, that there can be no difficulty in distinguishing them from each other, or from any of the other varieties of ulcers. A high degree of constitutional disturbance attends each of these varieties. The constitutional symptoms and treatment will be given in a future chapter.

GANGRENE AND SPHACELUS.

The three terms—Mortification, Gangrene, and Sphacelus, have been indiscriminately used by some authors to express an important result of inflammation, namely, the death of the part. In the use of them here we shall follow the guidance of those who regard *mortification* as a generic term, comprehending the whole series of phenomena, from the first diminution of the vital powers to their entire destruction; *gangrene*, as denoting the stage in which there is diminution but not perfect destruction of the powers of life; and *sphacelus*, as denoting the complete death of the part.

Local and Constitutional Symptoms of Gangrene and Sphacelus from Inflammation.—In gangrene the redness is changed into a dark or livid hue; the heat, sensibility, and pain are diminished; the swelling, though not diminished, but sometimes even increased in extent, is less tense, and generally pits on pressure; and on different parts of the surface we usually find portions of the cuticle elevated into small blisters, called phlyctenæ, containing unhealthy serum of a yellowish or greenish colour. These symptoms do not indicate an entire extinction of the vital powers; and, consequently, the part sometimes recovers, or only a very small portion of it becomes dead. Generally, however, the symptoms of gangrene merge into those of sphacelus. In this state the part presents a black, a dark, or an ash-grey colour, according as it is more or less exposed to the atmosphere; becomes cold, and not only ceases to be painful, but entirely loses its sensibility; instead of having the appearance of excessive distension, as in the inflammation preceding the occurrence of gangrene, becomes soft, flaccid, and shrunk in its dimensions; crepitates on pressure, and emits a peculiar, cadaverous, characteristic odour. Such are the local appearances of the sphacelated part. This part is called the *slough*, and the process by which it is formed, *sloughing*. When the mortification has a disposition to spread, the dark colour extends, and is insensibly lost in the surrounding parts; whereas, when the mortification ceases to spread, a red line, called the line of demarcation, separates the sphacelated from the living parts. This line is, in the living part, in immediate contact with the dead, and its appearance is always regarded as most important, as indicating not only that sphacelation or sloughing has ceased, but also that a process has been commenced by nature for the removal of the sphacelated part from the system. In this process, exudation and partial organization of fibrin precedes suppuration and ulceration; and thus hemorrhage from vessels, and infiltration into loose tissues are both prevented. As the process advances, the cuticle is separated from the line of adhesive inflammation, and the part exhibits the appearance of a circular vesicle; this gives way, and an inflamed and ulcerated surface is then brought into view, called the line of separation. The continuity of the parts being thus fairly interrupted, the furrow deepens and extends, till the sphacelated portion is entirely detached, leaving, generally, a healthy granulated surface. In this very remarkable process there are various results of inflammation, namely—adhesion, which effects two purposes, preventing both hemorrhage and purulent infiltration—ulceration and suppuration; the ulceration being for the purpose of effecting the separation. The process is the same, whether it extends only to a certain depth below the surface, or whether the whole thickness of the part perishes. In the latter case, remarkable as this process is, the surgeon does not leave to nature the work of amputation, partly on account of the length of time that would be required, and partly because of the irregularity and form of the stump that would be left, as the ulceration, in these circumstances, does not proceed perpendicularly to the surface, but in a slanting direction, leaving the bones uncovered. To obtain, therefore, a more useful stump, the surgeon resorts to amputation. The question of amputation, and the time and site that ought to be selected when it is advisable, will be subsequently considered.

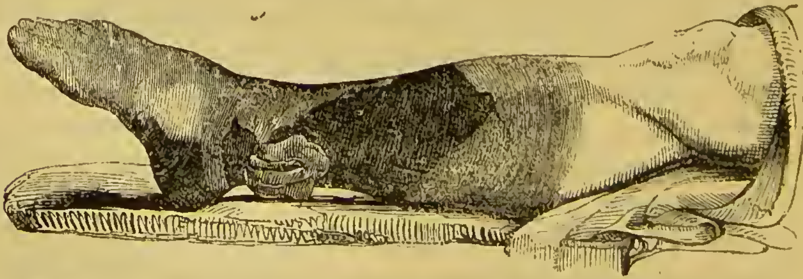
Local changes in inflammatory Mortification.—Dr. Bennett, to whom the profession is much indebted for his valuable "Treatise on Inflammation," gives the following description of the condition of the parts in inflammatory mortification :—"Occasionally a very large amount of blood-plasma is thrown out, constituting a violent inflammation ; a greater or less number of capillaries are also ruptured, and blood-corpuscles are more or less mixed up with the *liquor sanguineus* exuded. The exudation thus formed compresses the part, so as to obstruct the blood-vessels, and prevent the continuation of any circulation in it. Under these circumstances, instead of forming a blastema for the production of new organisms, it undergoes chemical changes, which induce in it decomposition, and the part is said to be mortified, or to be affected with moist gangrene. This change commences first in the blood extravasated, which becomes of a purple colour, more or less deep; corpuscles break down and become disintegrated; their hematosine dissolves, and colours the serum, and should the exudation have coagulated, it forms brown, rust-coloured, purple, or blackish masses. An acrid matter is now formed, which, acting on the neighbouring tissues, produces fetid gases, that are abundantly given off from the affected part. Sulphuretted hydrogen is evolved, which causes the blackish sloughs usually observed in such cases, and discolours silver probes, and the preparations of lead. After a time, the elementary tissues surrounding or involved in the exudation, become more or less affected. The transverse striæ in the fasciculi of voluntary muscles become first pale, and are then obliterated. Cellular tissues, fat, and other soft substances, lose their connexion, and fall into an undefined granular mass. The tendons and fibrous tissues retain their characteristic structure for a long time after the other soft parts have been reduced to a softened pulp. The bones resist the action longer, but at length become rough, soft, and, commencing externally, are more or less broken down, and reduced to the same pulpy consistence and granular structure as the surrounding parts. As the tissues thus become broken down and fluid, they are discharged from the system in the form of an ichorous matter, which, examined microscopically, presents numerous granules, imperfect or broken down cells, blood-corpuscles, and fragments of filamentous tissue or other structures involved."

Constitutional symptoms of inflammatory Mortification.—During the inflammation which precedes the mortification, and when a disposition to form a line of demarcation is observed, the constitutional symptoms are those of inflammatory fever ; but when the mortified part is of great importance in the animal economy, or when the mortification is extensive, the constitutional symptoms very speedily merge into those of the worst typhoid type. Some of the principal symptoms are the following:—The pulse is rapid, thready, and feeble, in some instances irregular, and in others intermitting; but the most striking peculiarities of the pulse are, great diminution of strength, and great increase of frequency; and before death it becomes exceedingly indistinct and flickering; the patient lies on his back; the countenance is cold, and has an expression of great anxiety; the features are pinched, and the face has a peculiar livid hue; the tongue is at an early period furred and dry in the middle, and ultimately the whole of the mouth exhibits the same condition; hiccup comes on, and occasionally vomiting of a substance of a coffee colour; the patient is often observed picking at the bedclothes; the skin is at first dry, but as the case advances, it becomes cold and clammy; on pressing the hand to it, it feels raw, and is so relaxed, that on the hand being raised up, it gives the impression of sticking to the hand so as to follow it slightly and be raised up from the subjacent parts; the perspiration, like the other secretions, has a peculiar cadaverous odour; the evacuations are passed involuntarily; the patient sometimes retains his mental faculties to the last, but more frequently he is affected with low muttering delirium. Such are the symptoms that precede the closing scene in many examples of death from inflammatory mortification.

Such are the phenomena of acute, hot, or moist gangrene; all which terms have been applied to mortification when it is a result of the inflammatory process. This termination of inflammation seems to depend chiefly on the amount and rapidity of the exudation, and is much favoured by previous general debility, or diminished nervous energy of the part affected.

Mortification of a part may, however, arise from other causes than inflammation; thus, very severe burns, or the application of concentrated mineral acids, may each produce complete death of the part, before inflammation has had time to arise.

Fig. 13.



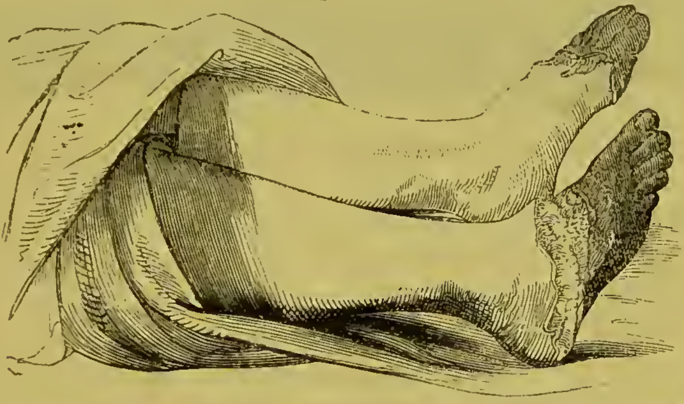
Gangrene after compound fracture, still spreading. No line of demarcation.—MILLER.

Severe mechanical injury to any part may occasion gangrene directly, or it may at first merely diminish the vitality of the part, and be the exciting cause of inflammation, which rapidly terminates in complete death of the part. When Gangrene arises from mechanical injuries, it receives the name of Traumatic.

The continuous application of intense cold to remote parts of the body, may, by greatly depressing their circulation, and by destroying their nervous energy, be the immediate cause of the death of the tissues, which lose their natural heat and sensibility, become discoloured, and assume a shrunken appearance.

But cold usually occasions gangrene in the following more indirect way. The application of it greatly diminishes the vitality of the part, which, either unavoidably or from imprudence, has had its temperature too suddenly raised; the consequence of which is, that excessive reaction is established, violent inflammation speedily ensues, and as the part, from lowered vitality, cannot control or withstand it, the inflammation quickly causes complete death. In some cases, gangrene of a part arises from a gradual failure of its circulation, caused by calcareous degeneration of the coats of its vessels. In this case complete death may ensue without the inflammatory process ever supervening; or the vitality of the part may be greatly lowered, from the deficient arterial supply; and after a time a low grade of inflammation is lighted up, which rapidly runs into gangrene.

Fig. 14.

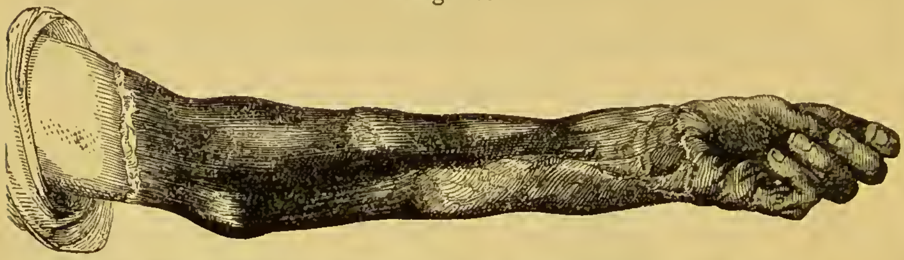


Chronic gangrene of feet after exposure to cold. Separation considerably advanced.—MILLER.

To gangrene, due directly to mere deficient circulation from arterial degeneration, the names of cold, dry, or chronic have been given, and the appearances presented by the part affected, are as follows:—The part presents a bluish-black, purple, or brown colour, loses its sensibility, and falls very much in temperature; shortly after which, the cuticle is raised into numerous blisters containing a serous or sero-sanguinolent fluid. These blisters soon break; and then the subjacent tissues, from exposure to the atmosphere, become dry, assume a brownish-black colour, and acquire a withered, shrunken, mouldered appearance. Should, however, the subcuticular parts not be thoroughly dried, either from imperfect access of air, or from some other cause, the slough very frequently presents a whitish or ash-grey colour instead of a black, and a wettish instead of a dry appearance. Hence another division into white and black gangrene; but they may both arise from the same cause, namely, deficient supply of blood.

General debility, from whatever cause arising, sometimes produces such impairment of nutrition in a part, as ultimately causes complete extinction of vitality; or it may powerfully depress the nervous energy of the part, and lead to its death more indirectly by strongly predisposing to the accession of inflammation, which, when once established, rapidly runs into gangrene.

Fig. 15.



Chronic gangrene; from general debility. Line of separation begun. Patient æt. seventy-five. —MILLER.

The term Gangrena Senilis is applied to a form of mortification very common in old people, and which may be owing to weakened circulation and lowered vitality, consequent on simple general debility; or it may arise from a deficient circulation, caused by arterial degeneration. This form of gangrene may be unpreceded and unaccompanied by inflammation, and then it is of the cold, dry, chronic form; or it may be caused by an attack of inflammation seizing on the previously ill-nourished part. When inflammation either has had the initiative, or has intervened during the course of the disease, the gangrene belongs to the moist variety.

Occasionally, although rarely, gangrene arises from the blood being deficient in some of its normal principles; and at other times, it is produced by the vital fluid being impregnated with some morbid materials. Thus, sloughing of the cornea has been occasioned by the use of food deficient in nitrogenous principles; and a peculiar form of mortification has followed the eating of rye with ergot.

Finally, we would observe that gangrene sometimes rages as it were epidemically, and can be ascribed to nothing else than some peculiar atmospheric influence. To this atmospheric influence many invasions of Hospital Gangrene must be attributed.

TREATMENT OF INFLAMMATORY GANGRENE.

Constitutional Treatment.—In all inflammations where there is the least reason to fear, that in the progress of the disease gangrene may occur, it should ever be borne in mind, that all antiphlogistic remedies, even at the very commencement of the inflammation, should be very sparingly used; because, however high the inflammatory fever may be, and however much it may seem to partake of the sthenic character, as soon as gangrene is fairly established, it rapidly changes to the asthenic, or the irritative type, and that it is only before the gangrene has ceased to spread, that antiphlogistics can be used at all. It ought to be remembered that the injudicious use of antiphlogistics, even at an early period, may render the constitution unfit to bear up during the exhausting discharges, the separation of sloughs, and the reparative process, by all which its powers will be severely tried.

Besides, it should be kept in view that it is in persons of debilitated powers of constitution, that gangrene very frequently occurs; and that in them, it is only the most cautious use of antiphlogistics that can be borne, even at the earliest periods; for the powers of the system may thus be so lowered as to make them fall victims to gangrene in even a comparatively slight inflammatory attack.

But while there can be no reason to doubt, that the danger of a fatal issue from sinking in the advanced stage may be greatly increased by the rash and too energetic employment of antiphlogistics in the early stage, yet, when intense inflammation takes place in an important part in an individual of robust constitution, and the fever is undoubtedly of the sthenic character, the early and judicious employment of bloodletting and other antiphlogistics should be enjoined as holding out the greatest hope of preventing the occurrence of gangrene.

Every year's experience impresses me more and more with the importance of guarding against impairing the general powers; and in no class of cases is this caution more necessary for the subsequent safety of the patient, than in the treatment of many inflammatory affections.

When gangrene is fairly established, the constitutional treatment consists in carefully guarding against everything that would exercise a depressing influence on the system, in keeping the patient at perfect rest, in supporting the powers to the utmost extent by the judicious administration of stimulants, and the use of a light nutritious diet easy of digestion, in paying careful attention to the state of the digestive organs, in regulating the bowels by the use of mild laxatives, in most particularly attending to have a supply of fresh air constantly admitted to the patient's apartment, in allaying the irritability of the system, and in procuring rest by the use of opiates, which are invaluable in the majority of cases of gangrene, and are to be given in quantities, and with a frequency, which the circumstances of each particular case will suggest to the surgeon.

Local Treatment.—Attention to attitude and removing the exciting cause are important points of treatment; and in certain circumstances, as in diffuse areolar infiltration of a purulent or urinous character, and in all cases where tension or pressure is combined with inflammation, free incisions will afford the greatest relief. By free incisions vessels are relieved of their blood, and tissues of effused fluids, tension is taken off, and causes of extension of gangrene and sloughing removed. Incisions, however, ought not to be indiscriminately resorted to; and it is only when they can fulfil some of the above indications that their employment can be beneficial. The use of turpentine and other stimulating application is attended with danger at every stage. Before the actual occurrence of gangrene they increase the action already excessive; in the parts already in a state of gangrene they can exert no beneficial effect; and in the surrounding tissues, they are apt to excite the inflammation to a degree to make it run from the adhesive to the gangrenous form, and thereby cause extension of the disease. During the formation of the sloughs, light poultices or warm water dressings are the most soothing and grateful applications, and during the separation of the sloughs, warm water dressings and solutions of the chlorides of lime or soda freely applied by means of lint, are the preferable applications for correcting fetor and maintaining the necessary reparative action in the living parts. Parts that are dead should be taken away as speedily as they are detached, to an extent to admit of their being removed without cutting or pulling off living parts. But when the detachment can be effected by cutting parts already dead with the scissors, pliers, or other convenient instrument, and when all sloughs are fairly removed, the part and the system should be treated as the general principles suggest.

Question of amputation.—In all cases of chronic and dry gangrene dependent on an internal cause, and in cases where the influence of the internal cause predominates, the rule of practice is, not to wait only for the line of demarcation, but for the process of separation to be fairly established, and then to effect amputation with as little interference with the living parts as is compatible with obtaining such covering of the bones as may be necessary for a serviceable stump.

Two rules in such cases should never be departed from—to wait for the line of demarcation, and to amputate with the least interference with living parts that may be compatible with obtaining a useful stump. Were a surgeon to disregard the rule as to time, he would in all probability amputate in parts about to die; and were he to neglect the rule as to the least possible interference, he would run the risk of exciting a degree of inflammation in previously weakened parts, which their diminished vital powers would be unable to sustain. The same rules of practice are applicable to a form of gangrene produced by one external cause, namely, that which results from cold.

In all cases of true traumatic or rapidly spreading gangrene, the surgeon is beset by dangers on every side. If he waits for a line of demarcation, he will wait in vain; the gangrene spreads rapidly towards the trunk, and he loses his patient; and if he amputates immediately, he runs the great risk of a fatal termination from gangrene attacking the stump. As the only chance of life, however slender, lies in immediate amputation, it ought to be performed at once, and at a point high above the part affected. The extraordinary rapidity with which the disease spreads in the cellular tissue, and its being much more extensive there than in the skin, makes the observance of these directions exceedingly necessary. As the source of danger is the recurrence of the gangrenous inflammation in the stump, that danger would be increased by operating in the proximity of the gangrene, and, therefore, the site of amputation should be as remote as possible; high up in the thigh, when the disease is in the leg, and at the shoulder joint or immediately below it, if the gangrene be in the arm. Light dressings, the free administration of nourishment, stimulants, and full doses of opium constitute the proper treatment after amputation.

I have seen many patients die under the above-mentioned treatment, but have had also the gratification of seeing a good many very unpromising cases recover under it.

THE GENERAL PRINCIPLES OF TREATMENT OF INFLAMMATION, AND THE RATIONALE OF THEIR OPERATION.

Of the various modes of treatment of inflammation, the principal are the following:—

I. In former days, when inflammation was met with at an early stage in a person of sound constitution, and attended with fever of a sthenic character, the treatment adopted, and which even until lately was universally believed to be the most successful, consisted of the antiphlogistic regimen and remedies.

Antiphlogistic Regimen.—On this subject Dr. Alison remarks:—

"The object of the antiphlogistic regimen is simply to remove every excitement or irritation which may augment either the strength or frequency of the heart's action, or promote the flow of blood towards the affected part; it being perfectly ascertained by experience, and indeed easily understood, whatever doubts we may entertain as to the rationale of inflammation, that when that state exists in a constitution otherwise healthy, it is aggravated by whatever promotes and accelerates the flow of blood to the affected part.

"Hence the strict antiphlogistic regimen consists essentially of three parts, *low diet*, *rest*, and *quietude*. The abstraction, in the most urgent cases, of all solid aliments, in all cases, of animal food, and the denial of all fermented and spirituous liquors, imply a gradual diminution of the quantity of the blood, and the removal of stimuli, by which the heart's actions are obviously and strongly excited. The cessation of all vigorous or sustained muscular movement likewise removes a cause by which the circulation is obviously and often powerfully excited; and the exclusion of all sudden and strong impressions on the organs of sense, secures the body against a set of irritating causes, which act primarily on the nervous system, but always more or less excite the vascular system likewise, and very frequently, by preventing sleep, manifestly aggravate the fever which is consequent on inflammation.

"With the same general intention, various more particular precautions are of importance in the inflammation of individual organs; in all cases, the removal of any exciting cause of inflammation which can be detected—the horizontal position and absolute rest of an inflamed limb to retard the afflux of blood to, and favour the reflux from, the part affected—the erect posture, when the head or any part of it is inflamed; the prohibition of all efforts of voice, when the lungs or other organs of respiration are inflamed; the contact of soft substances only with inflamed portions of the surface; the injunction of darkness and silence in inflammations of the eye and ear, &c. Under these precautions, the body in general, and the affected parts in particular, are placed in circumstances the most favourable to the gradual and spontaneous decline of inflammation."

Antiphlogistic Remedies.—Of all antiphlogistic remedies, the most important is bloodletting. Blood may be taken from the system at large, or from the affected part. The treatment in the one case constitutes general, and in the other, local bloodletting.

General Bloodletting.—The effect of general bloodletting in arresting inflammation, is owing principally to its lessening the force of the heart's action—its causing derivation of blood from the part—and its facilitating the action of other remedies. A sedative result on the heart's action is effected, partly by withdrawing from the central organ of circulation a part of its natural stimulus, the blood, by which its action is habitually maintained; and partly by the intervention of an impression produced on the nervous system, it being well known that the sudden diminution of pressure on the brain and medulla oblongata has a remarkable effect in diminishing the frequency and force of the heart's action. For more rapidly securing this effect upon the brain, the patient may be bled in the erect posture, so as to make gravitation and the loss of blood combine to produce the effect — a small loss of blood often speedily causing fainting, and insensibility, with great diminution in the force and frequency of the heart's action. That bloodletting is useful on the principle of derivation, has been a belief with many since the time this doctrine was powerfully advocated by Haller. Dr. Alison remarks: —

"The effect of bloodletting in causing *derivation* from parts actually inflamed to other parts of the body, has not been studied with so much care as might have been expected from the pains bestowed on it by Haller. Whether this effect is, as he thought he had ascertained, inexplicable on merely mechanical principles, or whether, as Magendie and Poiseuille assert, it is merely the effect of the contractile power of the vessels, and the forced state of distension in which they exist during life, causing a flow to any point where an opening is made, it is quite certain that a movement in that direction is immediately perceived in all the small vessels which can be brought under the field of the microscope, on a puncture being made in any one of them; and, in Haller's observations it distinctly appeared that this movement often inverted the natural course of the circulation, and often extended to portions of blood which were stagnating in vessels, and caused globules to separate and become distinct which had previously combined into irregular masses. This being so, it cannot be doubted that similar changes must be effected, in a greater or less degree, in the blood stagnating in inflamed parts, when an exit is given to the blood from other parts of the circulating system, whether by general or local bloodletting. And it does not seem possible to understand on what other principle than this, bloodletting can be useful, as it undoubtedly is in certain cases of inflammation, chiefly abdominal, when the pulse is smaller and even feebler than natural, but becomes fuller and stronger; or in others (chiefly of the head, sometimes of the abdomen likewise), when it is slower than natural, small and sharp, and becomes more frequent and fuller, after the evacuation."

The action of other remedies is facilitated by bloodletting. "By lessening that morbid impetus of blood, and increased tone of vascular coats, by which during the state of inflammatory fever the natural secretions are apparently impeded, and at the same time promoting absorption into the blood, as loss of blood is well known to do, it favours the effect of all other evacuating remedies: and further, by its precedence it renders certain remedies—as mercury and opium—decidedly beneficial, which otherwise would have proved either inoperative, or absolutely injurious."

The expediency of taking away blood is judged of, not by one, but by several circumstances, the chief of which are—the quality of the pulse, the violence of the inflammation, the importance of the organ affected, the stage of the disease, the age and constitution of the patient, the degree and character of the accompanying fever, and the nature of the prevailing epidemic, of which the inflammation may be an accompaniment. As regards the pulse, hardness and strength are the best warrants for bleeding; and along with these, in certain circumstances, frequency. The chief conditions which justify this proceeding are the following,—when the organ inflamed is a vital one, or one of great importance, when the disease is in an early stage, when the patient is otherwise healthy and of sound constitution, when the organ inflamed is one in which exudation would cause serious or abiding damage, when the accompanying fever is very high and of a sthenic character, and when the prevailing epidemic is distinguished by severity and well-ascertained peculiarities. On the other hand, it should ever be kept in mind that general bloodletting is a very potent agent; that it is altogether unwarrantable in the very young, the aged, the weak, or otherwise unhealthy; that it can exert no favourable influence, but quite the contrary, on the exudations of inflammation, by rendering the system less capable of setting up the actions by which they can be removed, and can only, therefore, in any circumstances, be admissible at a very early stage; and that congestions, serous effusions, general debility, and distressing manifestations of particular diathesis are some of the many sad results of the injudicious abstraction of blood. It has been well said of general bloodletting, "It is a spoliative remedy of the highest class; and therefore never to be had recourse to unless circumstances declare it imperatively demanded, or at least highly expedient. There is every reason to fear that this little operation is still too frequently employed; unnecessarily, when it might have been well superseded by other more gentle measures; unwarrantably, when actually no benefit, but sad injury has flowed from, and with, the purple stream."

General bloodletting may be effected from a vein, the proceeding being then called venesection or phlebotomy; or from an artery, when it is called arteriotomy. The most convenient mode is the common one, from the veins at the bend of the arm. Should these veins be very small, or very deep, as they sometimes are in persons affected with obesity, another vein, as, for example, the cephalic, may be selected; or, in certain special cases, the external jugular vein in the lower part of the neck. Should arteriotomy be resolved upon, a superficial branch of the temporal artery is generally selected; and from it blood can be taken with sufficient rapidity to produce a sedative effect, but, for reasons which need not be stated here, this operation is very rarely resorted to.

Local Bloodletting.—The object of local bloodletting is, sometimes, the speedy unloading of the gorged vessels; and with this view the blood may be taken from the inflamed vessels themselves by scarification, incision, or puncture; but, more frequently, local bloodletting is employed with the view of relieving the affected part, by diverting the flow of blood into a new channel. When employed to act by causing derivation, or as an auxiliary, or to produce an impression on the inflamed part by diminishing the general tone of the circulating system, so as to be a substitute for general depletion, the blood is taken by cupping, or by the application of leeches. The conditions in which preference should be given to one of these methods of local depletion over the other, will appear in future parts of this work.

Until a recent period, general bloodletting was considered by almost all, and still is by many, as the *summum remedium* in acute inflammatory diseases, and as a means by which inflammation may, in certain circumstances, be cut short. We have, therefore, dwelt at greater length on this remedy than the infrequency of its employment at the present day might seem to justify; and without entering into the controversy as to whether or not "there are waves of time through which sthenic and asthenic characters of disease prevail in succession, and that we are at present living amid one of its adynamic phases," certain it is, that although to dispense with bloodletting in all cases would be unsafe, yet it is now comparatively seldom employed; and a general impression prevails of the necessity of aiming at the most limited abstraction of blood, and of endeavouring to secure the advantages with as few of the disadvantages as possible, in cases where its employment may be considered indispensable.

Antimony.—Of various sedative remedies, one of the most important is tartrate of antimony, given in small doses of from a quarter of a grain to half a grain every two or three hours, so as to produce a nauseating effect. Through the intervention of this sensation, depression of the heart's action is produced; and, in consequence of this effect, it is believed by the profession in this country, that it is useful when exhibited alone, or as an auxiliary to bloodletting. On the Continent, authorities of great reputation have expressed a confident belief that, when given in repeated large doses of ten grains, and more, after tolerance of the medicine has been established, it is a powerful antiphlogistic remedy, while it produces no other sensible impression. In some inflammations, especially those attended with nausea or vomiting, this remedy is contra-indicated; but in others, and particularly in inflammation in the chest, it is of great value when employed alone, or as an auxiliary to bloodletting.

Mercury.—Practitioners are firmly convinced that mercury is extremely useful, when given as a purgative at the commencement of inflammation, especially in inflammations within the head, and in other parts also—that it has the power of controlling and removing exudation of lymph in inflammations of the iris, synovial membrane, and other delicate textures, when given so as not to act as a purgative, but to affect the system—that it tends to arrest the organization of exudations, and render them more amenable to absorption—that it acts directly on the blood, producing a diminution of the abnormal portion of fibrin—and that it is therefore, in many circumstances, a most valuable remedy. But, on the other hand, it is equally certain that much mischief often results from its injudicious use; and therefore it is only when exceedingly important textures or functions are in danger, and after due consideration of the state and constitution of the patient, that its administration should be ventured upon; and in no instance should it be given with a view to do more than just sensibly to affect the gums; and if the symptoms have subsided, it should be withdrawn before the mouth is affected. It is usually given in combination with opium, the opium preventing purging, and thereby promoting the constitutional effect of the mercury.

Opium.—Than opium after bloodletting we have not a more valuable remedy. By it the nervous system is soothed, pain is subdued, the sedative effect of bloodletting on the general circulation maintained, and sleep is procured. Its use is of vital importance in some inflammations, and especially in some inflammations of the intestines, by diminishing the pain which gives rise to the nausea, in consequence of which the heart's action is often so alarmingly, and it may be, fatally depressed.

Various Methods of Derivation.—Of various remedies which act on the principle of derivation, some of the most important are, certain purgatives and the different forms of counter-irritation. In inflammations within the head, purgatives are extremely useful; in inflammations in the chest, they are less important, except so far as they relieve the febrile state, by unloading the bowels; and in many inflammations within the abdomen, their use must not be ventured upon until the disease has been subdued. But the limits of this work will not allow me to enter on the subject of the precautions regarding the use of them, of counter-irritation, of cold in certain cases, of emetics in some special inflammations, and of some other remedies occasionally resorted to in the treatment of the inflammatory process.

II. We have now to mention the method of treating inflammations pursued by Dr. H. Bennett, who considers the principles on which bloodlettings and other antiphlogistic remedies were practised, entirely opposed to a sound pathology. The doctrine held by this distinguished physician may be briefly stated as follows:—When an exudation has once occurred, in order that it may be removed, it must undergo certain changes by increased cell-growth, for which transformations an increased supply of blood to the part is absolutely necessary; that bloodletting can in no way lessen the amount of blood in an inflamed part, or assist in the excretion of morbid products from the vital fluid; that the character of the pulse cannot be a safe guide to the propriety of bleeding, as its condition is the result, instead of the cause, of the inflammation; and that the increased throbbing and circulation of blood about an inflamed part is a result of the inflammatory process, a wise provision, as he says, of nature, to further the vital changes, and ought to be assisted rather than opposed.

The removal of an exudation can be effected only in two ways: either by its death or by its undergoing certain vital changes by cell-growth, for which an increased supply of blood to the part is absolutely necessary. Thence, according to this authority, the old principle of striving to diminish the flow of blood to an inflamed part is entirely erroneous, as the "blood, instead of being sent by a *vis a tergo*, is, in fact, drawn by a *vis a fronte.*"

From the following quotation it will be seen that Dr. Bennett does not believe that the old impression in respect to diminishing the amount of fluid in the inflamed part by withdrawing a large quantity of blood from the system, is in any degree correct :—"In an inflamed part the vessels are enlarged, the current of blood is arrested, the blood corpuscles are closely aggregated together, and distend the vascular tube, and are in no way affected by the arterial current, even when increased in its neighbourhood. That opening a vein can alter this state of matters is scarcely to be conceived ; and if it could, how would this assist in removing the exudation which has coagulated outside the vessels?"

The only effect, he remarks, that bloodletting carried to such an extent as to make any impression on the system, can have on an inflamed part is, "that the exudation, which requires more blood in order that it may undergo the necessary transformations previous to removal, is then arrested in its development, and so far from being rapidly removed, remains stationary, or dies in proportion as the economy is exhausted."

He further asserts, that the state of the pulse is a result of the process set up by nature to get rid of the inflammation ; and that any interference with the view of altering this state prolongs, rather than shortens the inflammation.

Finally, he remarks, that bloodletting does in no way assist in the excretion of morbid products from the blood, and in no way affects the characteristic peculiarities observed in the constitution of this fluid during the inflammatory process.

Dr. Bennett, believing that an inflammation once established can never be cut short, and that the exudation is got rid of by increased cell-growth, which cells, as he says, are all subsequently broken up and absorbed, or partly converted into a solid tissue, and partly absorbed, never tries in practice to cut short the disease, or to weaken the pulse and vital powers ; but, on the contrary, to further the necessary changes which the exudation must undergo in order to be fully excreted from the economy.

To this end, he states, citing pneumonia as an example, "during the period of febrile excitement, I content myself with giving salines in small doses, with a view of diminishing the viscosity of the blood. As soon as the pulse becomes soft, I order good beef-tea and nutrients ; and if there be weakness, from 4 to 8 ounces of wine daily. As the period of crisis approaches, I give a diuretic, generally consisting of half a drachm of nitric ether, sometimes combined with 10 minims of colchicum wine, three times daily, to favour the excretion of urates. But if crisis occur by sweat or stool, I take care not to check it in any way."

Such are the views, first, of the extreme antiphlogistic school, and secondly, of those who, like Dr. H. Bennett, hold that it is impossible to cut short an inflammation, and make the rule of practice to further the natural changes necessary for the removal of the exudation.

While I consider the profession to be deeply indebted to Dr. Bennett for his great researches, and for his valuable additions to the science of medicine, and while I cannot but admire the consistency of his therapeutic measures, based on his extended pathological knowledge, still I cannot but avow that I have seen cases of inflammation, which I believe were cut short by a timely bleeding; and others, which I as strongly believe were benefited by the antiphlogistic treatment, pursued in the modified measure, according to which I have always practised it. I have no experience of the antiphlogistic treatment carried to the extent that some recommend; and I firmly believe, that general bloodletting is but very rarely required, or even justifiable; yet I believe the antiphlogistic treatment to be a safe rule of practice, when pursued with the most anxious attention, not unduly to lower the strength of the patient at first, and to maintain it in the more advanced stages of the disease.

I cannot help thinking that the question as to which is the safer therapeutic rule, has been too exclusively argued in reference to pneumonia and some other affections, in which there is a very great tendency to spontaneous cure by processes now clearly understood and generally acknowledged; and that the comparative merits of the different methods cannot be properly appreciated until the respective results be ascertained in other inflammations. For my own part, in the present state of our knowledge, I should not be satisfied that all had been done to save the life of a strong plethoric patient, suffering from acute inflammation in the head, if early bleeding had not been practised. I think that the chances of a patient's recovery, under these circumstances, would be much greater, were means adopted to prevent exudation, rather than to favour changes in it.

III. To conclude, it may be stated, that other methods of treating inflammation have been adopted with varying degrees of success. Thus, Rasori and Laennec treated inflammations by administering tartar emetic in very large doses; others, as Dietl, have tried pure dietetic treatment; others, as Skoda, in the Charity Hospital at Vienna, have pursued the expectant plan, that is, dietetic treatment combined with the administration of remedies to meet occasional symptoms; and the late Dr. Todd latterly advocated powerful stimulation from the very commencement of acute inflammation. The limits of this work do not admit of more than a mere mention of these various plans, and for fuller information as to their nature, and the comparative success resulting from their adoption in certain forms of inflammation, we would refer the reader to the writings of the above-mentioned authorities, and to papers by Dr. G. Balfour, in the "Edinburgh Medical and Surgical Journal" for 1847.

CHAPTER II.

TUBERCLE.

o exudations occurring in a sound constitution, the term simple or ealthy is applied ; while to those taking place in the scrofulous or ancerous diatheses, the names of scrofulous or tubercular, and canerous, are respectively given.

The peculiar condition of the blood found in persons of the scroflous or tubercular diathesis, consists in its containing a larger amount f albuminous, and a less quantity of oily matter, than enter into its onstitution in a state of health. This, as pointed out by Bennett, rises from there being such an amount of acidity in the alimentary canal, as readily dissolves all the albuminous substances, and more han neutralizes the various alkaline secretions, so that carbonaceous principles of food are not converted into fat, and oily matters directly ntroduced into the system are not properly assimilated. Should exudation of liquor sanguinis arise from any cause under these circumstances, it will have the same peculiar constitution as the blood; that is, it will contain a large amount of albumen, but be deficient in fatty matter ; and as a proper combination of these two principles is necessary for nutrition and development, the elementary molecules do not undergo any higher development into nucleated or reproductive cells, but remain as unorganized abortive bodies, to which the name of tubercle corpuscles has been given. On this interesting subject, Dr. Bennett writes :—" A healthy nutrition of the body cannot proceed without a proper admixture of mineral, albuminous, and oleaginous elements. This may be inferred from the physiological experiments of Tiedemann and Gmelin, Leuret and Lassaigne, Magendie, and others ; from an observation of the constituents of milk, the natural food of young mammiferous animals ; from a knowledge of the contents of the egg, which constitute the source from which the tissues of oviparous animals are formed before the shell is broken ; and from all that we know of the principles contained in the food of adult animals. The researches of chemists, as of Prout, Liebig, and others, point to the same generalization, when they assert that carbonized and nitrogenized, or, as they have been called, respiratory and sanguigenous food, are necessary to carry on nutrition, inasmuch as oil is a type of the one, and albumen of the other. The reason of this was first pointed out by Dr. Ascherson of Berlin, in 1840, and made known by me to the profession in this country in 1841. I have since endeavoured to show, that the elementary molecules formed of a particle of oil, surrounded by a layer of albumen, which are produced, as he described, by rubbing oil and albumen together, are not developed directly into blood-globules and other tissues, as he supposed, but must first pass through a series of transformations—a knowledge of which is highly important, not only to a comprehension of nutrition generally, but especially of that abnormal condition of it which occurs in phthisis. Thus the successive changes which occur for the purposes of assimilation in the healthy economy may be shortly enumerated as follows :—1st, Introduction into the stomach and alimentary canal of organic matter. 2nd, Its transformation by the process of digestion into albuminous and oily compounds : this process is chemical. 3rd, The imbibition of these through the mucous membrane in a fluid state, and their union in the termini of the villi and lacteals to form elementary granules and nuclei : this process is physical. 4th, The transformation of these, first, into chyle corpuscles, and, secondly, into those of blood : which is a vital process. It is from this fluid, still further elaborated in numerous ways, that the nutritive materials of the tissues are derived, so that it must be evident, if the first steps of the process are improperly performed, the subsequent ones must also be interfered with. Hence we can readily comprehend how an improper quantity or quality of food, by diminishing the number of the elementary nutritive molecules, must impede nutrition."

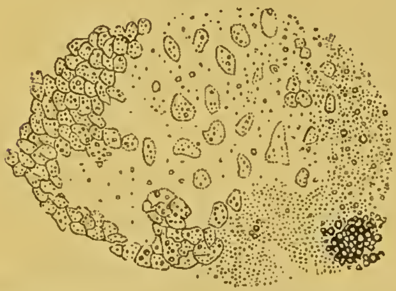
Although simple or healthy exudation is essentially connected with the inflammatory process, tubercle or tuberculous exudation may or may not be dependent on it; for, in one case, it may arise from mere perverted nutrition, whilst in another, it may be occasioned by an abnormal degree of vascularity, which may never exceed mere congestion, or may pass into actual inflammation. On this point Dr. Watson remarks :—" In my opinion there is not a shadow of evidence to show, that the deposit of tubercular matter is always and necessarily preceded by inflammation. Yet an undoubted and most important connexion obtains between the occurrence of inflammation and the occurrence of tubercles. Tubercles will cause inflammation, and inflammation will determine the development of tubercles. The enlarging tubercles excite inflammation in the surrounding textures by the pressure they exert on them; and probably in other ways, by mechanically interfering with the healthy circulation of the blood, for example; and the inflammation lit up is usually of the scrofulous kind; it is slow, and partial, and easily quieted by treatment, though scarcely to be cured. On the other hand, there are numerous facts to prove that, in a person having the scrofulous diathesis, the occurrence of inflammation within the chest may arouse that previously dormant tendency into action, and become the exciting cause of the secretion or separation of tubercular matter from the blood."

Age.—Tubercular exudations may occur at all ages, but are most frequent in young subjects from the period of dentition to that of adolescence. During childhood and youth they most commonly occur in the lymphatic glands, especially the cervical and mesenteric. In adults, they are met with much more frequently in the lungs than in other parts. They are found in almost all tissues, and are common on serous surfaces, in areolar tissue, and in the testicle. In the common scrofulous affection of the lymphatic glands of the neck, and in scrofulous disease of the testicle, we have two examples of tubercular exudation, which frequently come under the consideration of the surgeon.

Common characters and varieties.—Tubercular exudation is of a dirty white, or opaque yellowish colour, and of various degrees of consistency, from that of a tough cheese to that of a much softer substance. Vogel remarks:—"Whenever tubercles are observed in what may be presumed to be their earliest stages, they appear solid, form a more or less dense mass, and fill up all the interstices of the elementary tissues in which they are deposited. The tissues are usually neither displaced nor altered by the tubercular matter; on the contrary, they in general retain their normal position; they are, however, as closely and perfectly invested by it, as the stones of a wall by the solidified mortar which has been applied between them." The exudation may be poured out in small, separate, isolated masses, surrounded by healthy tissue, or it may be generally diffused through the natural tissues without any definite boundaries; and hence the names of encysted, and infiltrated, which have been applied to tubercles. Again, two varieties are spoken of under the names of miliary tubercles, or grey granulations of Bayle, and of crude or yellow tubercles; the former described as small, hard, grey, semi-transparent bodies, about the size of millet-seeds, having irregular borders, either distinct or collected in groups, friable, and, when crushed, yielding little fluid; the latter as larger bodies, yellow or yellowish white in colour, softer in consistence, friable, and, when crushed, having an unctuous feeling, and smearing the surface on which they are pressed. Some pathologists describe the miliary or grey tubercles as the first stage of the crude or yellow; but others, as Rokitansky, deny that transformation of the miliary into the yellow form ever takes place. It will afterwards be seen that the two forms closely resemble each other in microscopic structure.

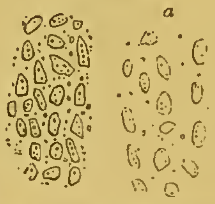
Microscopic and chemical characters.—When viewed with the microscope, tubercular matter is found to consist of numerous small, variously-shaped bodies, usually of a roundish, oval, or angular shape, composed of a wall enclosing from one to seven granules, but destitute of any distinct nucleus. These bodies are called tubercle corpuscles, vary in their longest diameter from $\frac{1}{2000}$ to $\frac{1}{1200}$ of an inch, are unaffected by water, are rendered very transparent by acetic acid, and are readily dissolved in a solution of potash. On careful examination, it will be observed that these corpuscles are mixed up with numerous molecules and granules, which vary greatly in size, and are more abundant the softer the tubercles are. Scattered also over the field of the microscope may be seen numerous shreds of the tissues in which the exudation was found.

Fig. 16.



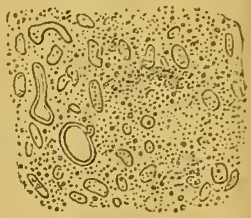
Tubercle corpuscles, &c., from a soft tubercular mass in the lungs.—From Bennett.

Fig. 17.



Tubercle corpuscles, with and without acetic acid, from the lung.

Fig. 18.



Tubercle corpuscles, granules, and debris, from the brain.

Some of these granules appear to consist chiefly of nitrogenized compounds, others of salts of lime, which, on the absorption of the animal matter, occasionally remain, constituting calcareous concretions. When the grey or miliary tubercles are carefully examined after being treated with acetic acid, they are found to be made up of a number of bodies quite similar to the ordinary corpuscles, but usually more closely pressed together, and containing rather fewer granules.

From chemical analysis, tubercle would appear to consist of an animal matter, containing a large amount of albumen, and of various earthy salts, principally the insoluble phosphate and the carbonate of lime, and a small proportion of soda salts. Some chemists have detected caseine; and very minute quantities of fat and fibrin may generally be found to enter into the constitution of tubercular matter.

Mode of increase and softening.—As tubercular deposit contains no nucleated or reproductive cells, its increase can be effected only by fresh exudation. It may either remain without change, or be absorbed; or, by acting as foreign matter, may induce irritation and inflammation in surrounding tissues; and becoming softened by admixture with inflammatory products, may with them form scrofulous abscess, in which the tubercular and purulent matters are commingled. Examples of such abscesses are of frequent occurrence. According to Engel, Vogel, and others, the causes of softening of tubercle may be referred partly to influences residing within the tubercular mass, and partly to such as are external, as extreme moisture, suppuration in the surrounding tissues, &c. When scrofulous pus is examined by the microscope, the corpuscles are seen to be irregular in shape, instead of having the regular round or spherical form of healthy pus cells; they do not, moreover, roll freely on each other in the liquor puris; and if acetic acid be added to them, it will be found that the granular nuclei are either entirely absent or very ill defined.

Degenerations.—When tubercles are once deposited in any tissue, they may soften or liquefy, giving rise to the formation of scrofulous pus; or they may undergo the calcareous degeneration, which consists in the earthy constituents being left, and the liquid parts of the tubercle removed by absorption; or they may experience the fibrinous transformation, when they become hard, dry, and cartilaginous-like bodies. When tubercles are once deposited in any texture, there are two ways in which they may undergo a process of natural cure. In the first place, they may soften and be evacuated as purulent matter; and, should no more exudation from the blood take place, the part affected may in this way undergo a process of spontaneous cure. But again, the more watery and animal part of the deposit may be absorbed, and the cretaceous matter left may remain for years as a harmless mass, provided the further deposit of tubercular matter be arrested.

Marks of diathesis and causes of deposit.—Tubercular exudation occurs exclusively in persons who have the scrofulous diathesis, which is, therefore, said to predispose to tubercle. This diathesis is hereditary, and is met with in persons of all temperaments, but is most usual in the sanguine and phlegmatic. The characters which indicate its existence in persons of the sanguine temperament are, light hair; skin fine, white, with a transparent brilliancy, allowing numerous subcutaneous veins to be seen shining through it; eyelashes long, silky, and graceful; iris grey or blue; eyeball prominent, the sclerotic having a shining whiteness or pearly lustre; the pupils large; the muscles flabby; the circulation feeble; the surface of the body easily chilled; and the digestive organs easily deranged. These are the principal physical characteristics, and with them are usually associated certain moral characters, namely, warm affections, quickness of perception, lively imagination, amiability of disposition, and a delicate and susceptible cast of mind. When the scrofulous diathesis exists in persons of a phlegmatic temperament, its principal characteristics are, dark complexion; skin thick, pasty, and sallow; head large; eyes large and prominent; upper lip, in general, thick: expression of countenance dull and unpleasing; muscles soft and flabby; chest narrow: belly protuberant; circulation feeble; digestive organs liable to derangement, with other symptoms indicating feebleness of constitution. The principal known exciting causes of tubercular deposit are, habitual insufficiency of food; deficiency of fresh air and exercise; residence in a low, damp situation; want of free exposure to the light of the sun; debility from excessive evacuations, or other causes; insufficient clothing; long-continued derangement of the digestive organs, great acidity in the stomach, and habitual mental depression. Dr. Alison says of the exciting causes of this deposit, "They may be ranked together as causes of debility, acting permanently or habitually for a length of time, although not so powerfully as to produce sudden or violent effects."

Treatment.—These considerations suggest very strongly the necessity of generous diet in all cases where the scrofulous diathesis exists, or when the local manifestation has taken place; of living in a dry bracing atmosphere; of free exposure to the light of the sun and exercise in the open air; suitable clothing; maintaining a healthy condition of the skin by some of the different modes of bathing, or by sponging, and friction with a hair glove; the proper regulation of the digestive organs; and the cultivation of habitual cheerfulness. Some medicines, more particularly the preparations of iron, quinine, or of quinine and iron, the syrup of the iodide of iron, cod-liver oil, and olive oil, are useful. It should be kept in view, that as strength can only be acquired by the proper assimilation of nourishment, one of the most important indications to be fulfilled by medicine, is to put the digestive organs into a suitable state for the proper performance of their functions, and especially to counteract excess of acid in the stomach. Medicine most likely to accomplish this desirable purpose should therefore be employed. Cod-liver oil is well known to be an invaluable remedy in all scrofulous affections, and in none is it more successful than in scrofulous disease of the glands of the neck, and scrofulous disease of the testicle. As M. Tauffied pointed out, cod-liver oil "is an analeptic, and is indicated in all cases of abnormal nutrition dependent on want of assimilation of fatty matters. It is readily digestible under circumstances where no other kind of animal food can be taken in sufficient quantity to furnish the tissues with a proper amount of fatty matter." In many instances cream is an efficient and agreeable substitute for the cod-liver oil. It is well known that tubercular deposit is much more under the influence of constitutional than of local treatment. As tubercle is clearly a disease of primary digestion causing impoverishment of the blood, as faulty nutrition originates and keeps up the disease, and as the nutritive properties of the blood are entirely dependent on proper assimilation, it must be evident from these, and other considerations mentioned in this chapter, that, to use certain kinds of food, especially those containing a large quantity of fatty matters, to promote primary digestion, and to remove all influences capable of interfering with the ultimate healthy elaboration of the nutritive fluid, are of the greatest importance.

CHAPTER III.

CANCER.

As all writers have not affixed the same meaning to some terms used in the nomenclature of the diseases described in this chapter, it may be proper to mention, that, in the following remarks, those of Cancerous Growths, Cancer, and Carcinoma are used synonymously, to denote a genus of disease of which there are several varieties or species, possessing certain principal characters in common, but having each at the same time some distinguishing peculiarities.

Of these varieties the four following are readily recognised; Carcinoma simplex, or Hard Cancer; Carcinoma medullare, or Soft Cancer; Carcinoma alveolare, or Colloid Cancer; and Carcinoma melanodes, or Black Cancer.

These various morbid formations differ widely in many of their characters, as will be stated when we speak of them individually; but they have certain peculiarities in common with each other, some of which are, that they are composed of elements which, considered histologically, differ from those of the normal body, and hence are called heterologous or heteromorphous formations; that they have a tendency to extend to surrounding parts, and change them to structures resembling their own; that they have a tendency to return after extirpation; that they are connected with constitutional cachexy; and that they not only destroy the parts in which they are deposited, but eventually, and at no distant period, the life of the patient.

A fifth variety of cancer, called Epithelioma, or Epithelial Cancer, will be included in this chapter.

1. CARCINOMA SIMPLEX.

Synonymes.—Carcinoma, Carcinoma simplex, Carcinoma scirrhosum, Scirrhus, Scirrhoma, Scirrhosis, Stone and Hard Cancer, are some of the names given to this variety.

Period of Life.—This form of cancer is observed at various periods of life, but its occurrence is most frequent between 45 and 50 years of age. It has been very seldom observed in persons under 20; but it becomes more frequent as the age increases up to from 45 to 50, after which it again becomes more rare; yet it is met with even in the most advanced periods of life less rarely than at ages under 20. Of all forms of cancer this is the one most common in middle-aged and elderly persons. The youngest subject in which I have seen the disease was a girl of 15 years of age, in whom the skin over the mamma was the seat of the disease. But in the "North American Medico-Chirurgical Review" for May, 1857, Dr. Goss records the case of a mulatto child, three months old, in whom the liver was affected with hard tubercles, which were of an extremely firm consistence, and exhibited under the microscope all the genuine characters of scirrhus.

Usual Seats.—Certain organs and tissues are more prone to this form of cancer than others. The mamma, liver, uterus, rectum, sigmoid flexure of the colon, ilio-colic valve, and stomach are favourite seats of this variety of cancer as a primary disease; the skin and lymphatics are sometimes, although very rarely, the seat of it as a primary, but extremely often as a secondary disease; whereas the bones, muscles, brain, lungs, spleen, and urinary organs are almost entirely exempt from hard cancer, except as a secondary disease. The primary cancers of bone are medullary, colloid, and osteoid. The cancer that commonly appears first in the lymphatic glands is the medullary; and in muscle it never begins as a primary disease; and indeed, muscle is almost never found the seat of hard cancer, except when the disease spreads continuously, or is multiplied contiguously to its primary seat. A remarkable circumstance in regard to textures which are most frequently the sites of this form of cancer is, that while some glandular viscera, as the mamma and liver, are liable to be affected with hard cancer, the testicle, which belongs to the same class, is so exempt from it that it has been questioned if it has ever been attacked by it; whereas it is well known that it is one of the most favourite seats of medullary cancer.

This disease is more frequent in females than in males; but statistics on the large scale seem to furnish pretty conclusive evidence, that this is owing to the great frequency of scirrhus in the female breast, and that the other organs seem to be more frequently attacked by this disease in males than in females.

Common Characters.—Hardness is a distinguishing peculiarity of this variety; it is firm and incompressible; at an early stage it is freely movable, but subsequently becomes firmly attached to the skin and subjacent parts; its surface is nodulated; the veins superficial to it become, at an advanced period of its growth, tortuous and enlarged; at its commencement it may be attended with little or no pain, so that considerable progress may have been made before the discovery of its presence; but ultimately, it is accompanied with acute pain of a lancinating character. In the first stage, the skin is unadherent and of its natural colour; in the second, it is adherent and of a dark purple-red colour; and in the third, it is ulcerated, and there is then constituted the condition called open cancer, or cancerous ulcer. When the skin has given way, there is soon observable one of the remarkable differences between the fibrous and the medullary cancer. In the latter, a fungus rises out of the ulcerated part; but in the former, instead of a fungus, the characteristic ulcer is formed. The characters of the cancerous ulcer are very peculiar, and may be recognised at a single glance. The edges are irregular, thick, serrated, everted, and sometimes of a whitish, and sometimes of a red irritable, appearance. The surface is foul and irregular, presenting at some parts patches of hard straggling granulations, which are soon removed by the ulcerative process; and at times, in some parts, some small portions of the tumour are seen coming away, in consequence of rapid ulcerative action, or of this along with separation of portions of the diseased structure, the ulcerated surface, in some cases, presents a deep and cavernous excavation. The discharge is thin, bloody, profuse, and of a peculiar fœtid odour. On the separation of some of the small sloughs, slight hemorrhage occasionally takes place. The patient is almost constantly distressed with burning pain; and however much the ulceration may extend, there is a peculiarity that may be observed—namely, that it has no effect in reducing the size of the tumour, owing to the circumstance that fresh deposition and growth in the subjacent part is more rapid than the ulcerative destruction on the surface.

Lymphatic invasion takes place, constituting the secondary formation. There are great varieties in regard to the time, the form, the extent, and the character of this invasion. In some cases it appears early, in others it is long of commencing. Sometimes the ganglia in the neighbourhood become much enlarged, so as to constitute the lymphatic tumour; and this tumour may, more or less, be perfectly joined to the primary cancerous tumour by a painful indurated cord-like swelling in the direction of the principal lymphatics; or nothing whatever may be felt between the seat of the primary and secondary formations. The secondary formations are sometimes in the viscera instead of the lymphatics. When in the viscera, they are usually of the medullary character; and of the scirrhous when in the lymphatics. A cachexy attends on this as on every other form of carcinoma, and is characterized by emaciation, great debility, sallowness of skin, a bloodless appearance, want of sleep, entire loss of appetite, a cadaverous expression of countenance, great suffering, and usually irregular hectic fever. After removal it creaks, when cut with a sharp knife; a thin lamina is pellucid, but in the mass it is white, with a bluish tinge; it is seen to consist of *two* distinct substances, one of a comparatively soft consistency, of a satiny appearance, and a bluish-white colour; the other and larger, of an opaque white appearance, of a paler colour than the soft part, and consisting of numerous interlacing bands; it is heavy in proportion to its bulk, and unctuous to the touch; by pressure or scraping, it yields a small quantity of cancerous juice, which, at an early stage, has the appearance of a clear transparent liquid, and afterwards of a white creamy fluid ; it is not furnished with a capsule ; does not present a distinctly defined border ; and is irregularly blended with the surrounding parts.

Fig. 19.

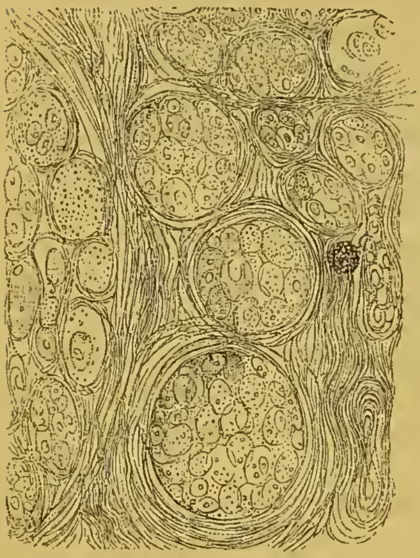
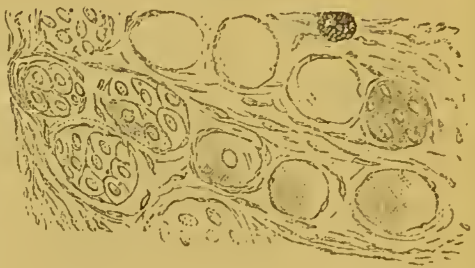


Fig. 20.



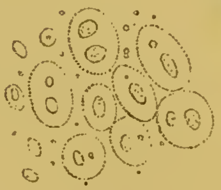


Fig. 22.

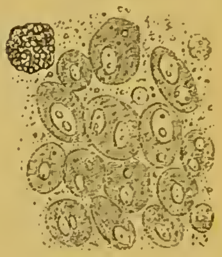


Fig. 21.

Fig. 19. Portion of the section from a carcinomatous tumour of the breast; consisting of fibrous tissue and cysts, enclosing cancer cells and granules. A compound granular corpuscle is also visible.

Fig. 20. Another portion of the same section treated with acetic acid. The fibrous tissue is rendered more transparent, and elongated nuclei are visible, scattered through it. The nuclei of the cancer cells are unchanged, while their walls are transparent. A compound granular corpuscle is seen at the upper part of the figure.

Fig. 21. Cancer cells from the cream-like juice squeezed from the tumour. Numerous granules, and a compound granular cell are seen.

Fig. 22. The same after the addition of acetic acid.—From Bennett.

Microscopic Characters.—When examined by the aid of a microscope, carcinoma simplex is found to consist of a fibrous matrix, so arranged as to form numerous cysts, in which, as well as between the meshes of the fibres, numerous cells are observed. These cells are highly developed, the walls being, in young cells, distended and smooth, and in old cells, flaccid and corrugated. In size they range from the $\frac{1}{1200}$ to the $\frac{1}{400}$ of an inch in diameter ; and in form they may be oval, caudate, round, spindle-shaped, oblong, heart-shaped, or of various indescribable forms depending on lateral pressure ; and this diversity is their most distinguishing character in respect to form. Each cell contains one, two, or more nuclei with enclosed nucleoli ; and frequently there is an appearance of cells within cells. The liquid contents of the cell-wall are at first transparent and colourless, but afterwards become opaque from the formation of granules and molecules. Water penetrates the wall by endosmosis, distending and raising it up. Acetic acid excercises its usual effect on it, dissolving it, and thereby making the nuclei more conspicuous. The fluid or juice which can be scraped or pressed from a cut surface

Fig. 23.

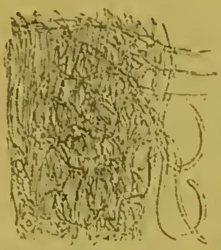


Fig. 24.

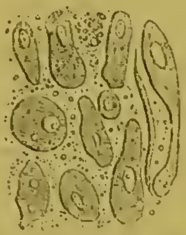


Fig. 25.

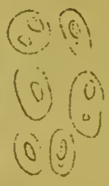


Fig. 23. Dense fibrous and elastic tissue, in which cancer cells are infiltrated from cancer of rectum.
Fig. 24. Cancer cells scraped from the surface, in the same case.
Fig. 25. The same after the addition of acetic acid.—From Bennett.

of the tumour is found to contain numerous cancer cells, granules, granular cells, pigmentary and fatty matters in variable proportions, blood-corpuscles, and shreds of fibres.

2. CARCINOMA MEDULLARE.

Synonymes.—Among the many names given to this variety are, Carcinoma medullare, Medullary Fungus, Fungus hæmatodes, Medullary Sarcoma, Medullary Cancer, Cephaloma, Encephaloma, Fungoid Disease, and Encephaloid, or Soft Cancer.

Seats, Age, and Sex.—In many particulars medullary and fibrous cancers contrast very remarkably with each other; and this is particularly the case in regard to their most usual seats, and the age and sex of the patients most frequently affected. The seats of medullary cancer in the order of frequency are, testicle, bones, intermuscular spaces in limbs, eye, breast, walls of trunk, and lymphatics. As formerly stated, the most frequent seat of hard cancer is the breast—occurring, according to Paget, in 95 out of 100 cases; whereas medullary cancer occurs more frequently in the testicle than in any other part. But not only are the testicle, bones, intermuscular spaces, and legs, the most frequent seats, but they are the parts in which it is met with at the earliest periods of life—medullary cancer being of frequent occurrence under puberty, and, with rare exceptions, the only cancer before puberty. In these parts the mean age is under 40, and, in all others, above 40. When the generative organs of both sexes are not taken into consideration, the writings and tables of Walshe, Lebert, and Paget do not seem to prove that the one sex is more liable to medullary cancer than the other.

Common and Microscopic Characters.—In this variety the tumour is less circumscribed, and its increase much more rapid; it is for a considerable time attended with little or no pain, nor does manipulation produce any uneasy sensation; on palpation it presents a peculiar elastic feeling, which has sometimes by inexperienced observers been mistaken for fluctuation; the veins over it become congested; the skin retains for a considerable time its natural appearance, but changes in colour as the disease advances, presenting a dingy bluish tint; it becomes tense and painful, and by and by ulcerates; a bloody fluid is evacuated, which soon assumes a fœtid character; a fungoid growth soon protrudes, presenting the appearance of an irregular surface of unhealthy granulations; the tumour comes to be attended with pain of a dull, heavy, sickening character; the fungus has a great tendency to bleed; the tumour increases very rapidly, affecting not only the surrounding parts, but also the neighbouring lymphatics and glands; and death soon takes place in consequence of repeated bleeding, invasion of internal organs, cancerous cachexy, or of gangrene of the upper extremity, as I saw very lately in a case of this disease in the breast, in which the gland and axilla presented one diseased mass. Secondary formations are often found to a great extent both in the lymphatic glands and in the viscera, and they occasionally are of the scirrhous character. The attendant cachexy is usually early, and comes to be strongly marked.

The tumour, on being cut into, is seen to consist in a great measure of a soft, white, opaque, pulpy substance, resembling in colour and consistency that of healthy brain, traversed with fibrous septa, which, however, are much fewer and thinner than in carcinoma simplex; and resemble those of carcinoma simplex in the denser parts of the tumour, but very slightly so in the pulpy and broken-down portions. Extravasations of blood give to the cut portion, at some places, a reddish appearance, constituting what has been called by some, fungus hæmatodes.

Fig. 26.

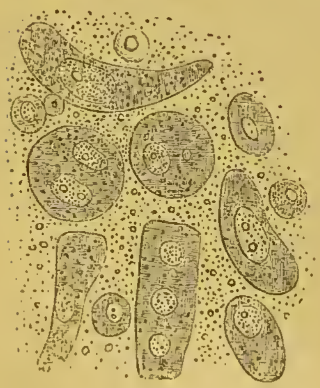
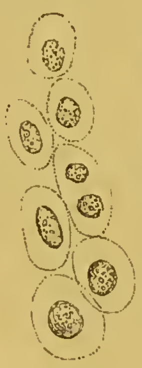
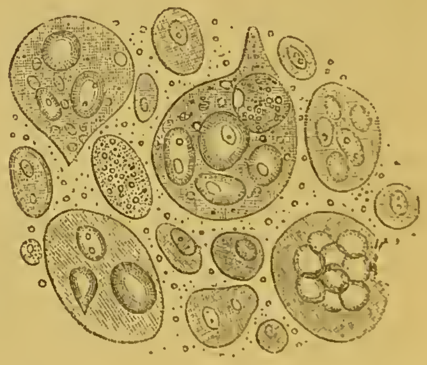


Fig. 27.



Older cancer cells before and after the addition of acetic acid.

Fig. 28.



Advanced cancer cells, including secondary cells.

The cells are more numerous than in the first variety, and more highly developed: and the cream-like fluid, when examined with the aid of the microscope, is seen to abound with cancer cells in a high degree of development. In this form of carcinoma there is often observed a yellowish-coloured paste, sometimes reticulated, and somemes collected into masses. This has been attributed to fatty de-

Fig. 29.

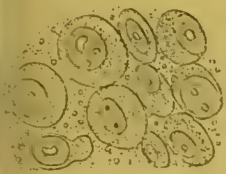


Fig. 30.

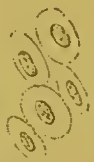


Fig. 31.

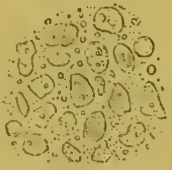


Fig. 32.

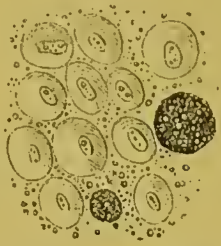
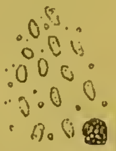


Fig. 33.



Cancer cells before and after the addition of acetic acid, lso the structure of the reticulatum from encephaloma f the testicle.

Young cancer cells before and after the addition of acetic acid.

generation of cancerous cells, and is described by Professor Müller as " cancer reticulare."

This variety of carcinoma differs from the former chiefly in density.

3. CARCINOMA ALVEOLARE.

Synonymes.—Carcinoma alveolare is sometimes called Colloid (from κολλα, *glue*) and also Gelatiniform cancer.

It is comparatively rare, and is met with as a primary disease principally in the stomach, intestinal canal, uterus, and omentum, and as a secondary disease in the lymphatic glands and lungs. It is found to consist of fibres, so arranged as to form loculi or areolæ, varying in size, and containing a soft viscous matter, sometimes grey or amber-coloured, sometimes opalescent, or opaque, or of a greenish-yellow colour.

Fig. 34.

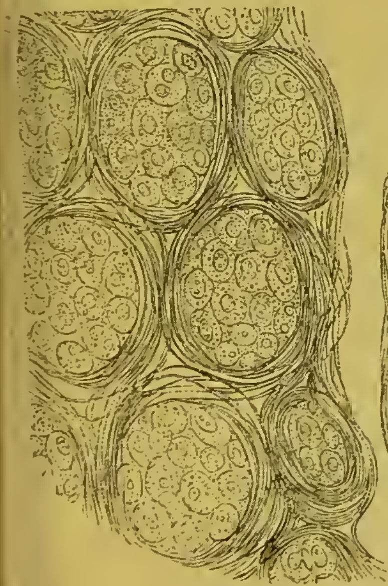


Fig. 35.

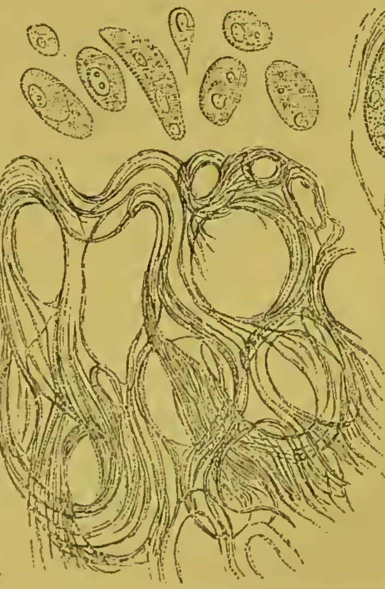
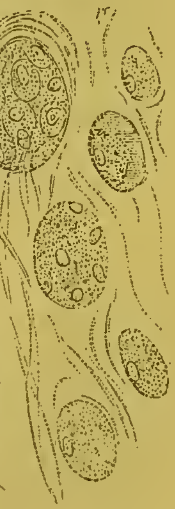


Fig. 36.



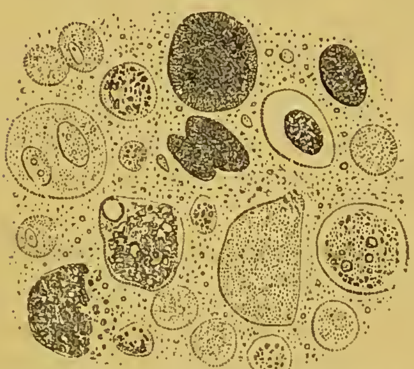
Structure of colloid cancer before and after the addition of acetic acid.—Bennett.

This glue-like matter is sometimes found perfectly structureless; sometimes it has a finely molecular appearance; while at other times it is observed to contain numerous nucleated cells, having the common characters of cancer cells. The accompanying figure, for which I am indebted to Professor Bennett, gives a delineation of this form of cancer.

4. CARCINOMA MELANODES, OR BLACK CANCER.

This tumour occurs much more frequently in the lower animals, especially in the horse, than in man; but in man the malignant character is more marked. Its most common primary seats are, the eye, the cellular tissue, and more especially the subcutaneous tissue, and that connected with the serous membranes. Sometimes it occurs as a distinct tumour with a fibrous stroma highly vascular, and with the colouring matter, which is non-vascular, diffused through it. When the colouring matter is viewed by the aid of the microscope, it is found to consist of minute granules, angular in form, and of a black or brownish-black colour.

Fig. 37.



Melanic cancer of the cheek; cells more or less loaded with black matter.—BENNETT.

It is frequently found associated with other morbid structures, especially with carcinoma medullare. It is attended with cachexia, has the power of invading surrounding structures, and assimilating them to itself, and shows the same progress as other malignant tumours; and when the diathesis is established, the lungs, liver, bones, or other organs, may be invaded.

5. EPITHELIAL CANCER.

Some distinguished histologists admit the epithelial as a fifth variety of cancer; but others exclude this form of tumour from the class of cancerous growths.

Whether from its minute structure it invariably deserves the name of cancerous is questioned by many; but whatever diversity of opinion may arise from examination of its histological characters, its malignant nature is strongly evidenced in its rapid growth, in its spreading from the parts primarily affected to deeper tissues, in its contaminating speedily the neighbouring glands, in its inducing cachexy, and in its having a great tendency to recur after removal.

The epithelial variety of cancer has its primary seat in or beneath some mucous or cutaneous surface, and is most frequently found on the tongue, the lips, the cheek, the scrotum, and the cervix uteri. It may, however, appear on other parts; and, indeed, is frequently found on the skin of the perineum, lower extremities, and trunk. It generally commences as a hard little tubercle, which, prior to ulceration, presents many varieties of shape and appearance, and very frequently closely resembles a common wart, from its surface being studded with numerous distinct papillæ. The surface is very often covered with a crust or scab formed of blood, detached epithelial or epidermoid scales, or else of dried, concreted discharge.

The ulcer which sooner or later forms, has commonly an excavated surface, and a foul appearance; is bounded by hard irregular edges, which are often everted; and usually emits an ichorish discharge. The tumour gradually extends, producing induration of the neighbouring parts; and when this has proceeded to a certain extent, the lymphatic glands become secondarily affected, cachexy follows, and at last the sufferer dies exhausted.

These tumours consist of a fibrous stroma, in which the papillæ of the skin are frequently found greatly hypertrophied, and the epithelial scales greatly multiplied and enlarged.

When viewed microscopically, the tumour is found to contain numerous flat, round, oval, or elongated cells, containing a simple nucleus; and other cells containing very large nuclei, which appear as if in process of development into nucleated cells.

Again, certain structures considered very characteristic of epithelial cancer, and designated by the names of "Laminated Capsules," "Cell Nests," and "Globes Epidemiques," are seen mixed up with the cells already described. These structures appear as if formed by the nuclei, described in the last variety of cells, swelling out until their walls meet that of the parent cell, thus forming a dense structure, composed of numerous concentric laminæ, enclosing an empty space.

ORIGIN, PROGRESS, AND TREATMENT OF CANCEROUS GROWTHS.

Cancer is believed by most authorities to be hereditary; but it is remarkable that statistics on a very large scale furnish by no means very conclusive evidence on this subject. I gladly avail myself of the following observations by Gross, on this subject:—

"Carcinoma is sometimes hereditary; not, however, so frequently as is generally supposed. Besides, it should be remembered that there is a difference, and that a very wide one, between the transmissibility of this disease from the parent to the offspring, and its co-existence, or successive development, in different members of the same family. The latter occurrence, although also very infrequent, is much more common than the former, of which my own experience has supplied me with only a few examples. Lately, I saw a lady with a well-marked cancer of the mammary gland, whose mother and maternal aunt had died of the same disease. In the summer of 1850, I prescribed for an aged female with a cancer of the lip, whose mother had perished from cancer of the breast, and the father from cancer of the tongue. But the most remarkable and instructive instance of this kind, probably, upon record, is that related by Dr. Warren, in his work on Tumours. A man died of cancer of the lip; his son had a similar disease in the breast, from which, after having undergone an operation at the age of sixty, he finally lost his life. Two of his sisters had cancer of the mammary gland; they were operated upon, but ultimately died from a relapse of the malady. A daughter of one of the ladies had a cancer of the breast, which was removed at an early period; she recovered, but perished some years after from disease of the uterus. A daughter of the gentleman had a cancer of the breast, and there was reason to believe that other members of the family were affected by the same malady.

"A case, almost equally remarkable, of this hereditary tendency to cancer, has been communicated to me by Dr. J. M. Warren. In this instance, a man who died of cancer of the penis, lost his father, grandfather, and great-grandfather, from the same disease.

"More frequently, as has been already stated, the disease occurs, either simultaneously or successively, in several members of the same family. My own practice has afforded me a number of instances of the kind, and there is not a writer on carcinoma that does not narrate examples of it. In one remarkable case, four out of six members of one family have died of the disease; one from cancer of the uterus; another from cancer of the mammary glands; a third from a malignant polyp of the nose; and the fourth from carcinoma of the thoracic viscera. Professor Gibson gives an instance of cancer of the breast in four sisters."

When exudation of liquor sanguinis has taken place, and has become coagulated, it presents, at the earliest period at which it has been examined, a finely molecular and granular appearance. This substance constitutes a blastema, in which the cancer cells arise. The change of the exudation into cancer is believed to depend on the constitution or inherent composition of the exudation, which constitution is determined by that of the blood. Fibrous tissue, cancer cells, and nuclei having been produced, the cancer cells propagate themselves, the old cell-walls give way, liberating the young cells or nuclei, which in their turn give rise to others. Fresh materials for assimilation are afforded to the tumour by exudation from new vessels developed in it; although just at the commencement of the disease, the exudation which constitutes the blastema takes place from the old vessels. The tumour thus possesses the property of growth and reproduction, and in that respect cancer differs from tubercle, which can only increase by fresh exudation, and new development of tubercular matter in the exudation, as tubercle does not contain nucleated or reproductive cells.

ncer
differs from
tubercle

Degenerations.—There seems reason to believe that a cancerous umour, after passing through its usual stage of growth, may degeneate, or be transformed into fibrous cicatrix, by the absorption of its ofter parts and the contraction of its fibrous stroma; or into a fatty nass, by the deposition of fat granules between the cell-walls and the uclei, rendering the cancer cells abortive; or into a calcareous conretion, by the absorption of the animal matter and the accumulation f the earthy salts of the exudation. But although these different orms of degeneration may have taken place in a very small number f instances, they are of so extremely rare occurrence, that no one hinks of looking for a spontaneous cure of cancer; on the contrary, it s found that the nature of the disease is to progress, and to conduct o death in some of the ways already mentioned.

The various forms of carcinoma appear to differ from each other principally in density, but to have all the same origin, the same progress, and the same result.

Treatment.—No medicine as yet known has any efficacy either in arresting the progress of a cancerous growth, or in altering the dyscrasia on which it depends; and therefore, any remedies given internally must be considered merely palliative. But it is nevertheless true, that, by a properly regulated diet, by due attention to the state of the various emunctories, and by the judicious administration of anodyne medicines, the surgeon can render the patient's condition less uncomfortable than it would otherwise be, and perhaps, to a small extent, ward off the fatal exhausting influence of prolonged pain, by affording temporary relief from suffering, when it is unusually severe.

We may therefore divide the treatment of cancer into the constitutional and the local, considering the former merely palliative; and comprehending under the latter, first, the means which have been proposed to retard the progress of a cancerous growth, and secondly, those employed for its removal.

Constitutional Treatment.—The diet of cancerous subjects should be nutritious, but light, easy of digestion, and, as long as the patient's strength continues good, very unstimulating. At the same time that proper care is taken as to the diet, due attention must be paid to keep the various emunctories freely open. An excellent authority remarks:—"Considering that, for the most part, the constitutional change is connected with excess of nutrition, and in this respect is altogether opposed to what we observe in cases of scrofula and tubercle, we may infer that lowering the nutritive processes while we yet allow the general tissues to be supported, should be the rule of practice."

When the patient's sufferings are severe, and his proper rest interfered with, anodynes and hypnotics, such as opium and hyoscyamus, must be had recourse to; and when his strength is much exhausted from prolonged pain, nutrients and stimulants must be freely administered to support the flagging powers, and nightly rest be obtained by opium or any medicine of the same class.

Local Treatment.—First: Means to retard the progress of growth. It is the experience of all practical men that the greater the excitement or irritation near a cancerous growth, the more speedily does the tumour grow; and hence a rule of practice based on this experience is, to avoid all unnecessary irritation near the cancer, whether by counter-irritants or in any other way; and should any excitement arise independent of our treatment, to attempt its reduction as speedily as possible. To relieve pain, and to maintain the integument entire as long as possible, belladonna or other sedative plasters have been recommended.

As heat, moisture, and room for expansion are three conditions most favourable for cell-growth in animals and vegetables, it has been proposed to retard the progress of a cancerous growth by subjecting it to conditions the opposite of these; namely, by freezing it by the application of ice, preserving the surface and surrounding tissues as dry as possible, and steadily maintaining carefully graduated pressure. The freezing plan has lately been recommended by Dr. James Arnot, and the method of graduated pressure has been instituted by Dr. Niel Arnot, both of which authorities speak favourably of the results obtained. They are suited only for cancers of external parts, and I have not in my own experience seen any such results from their use as would warrant me to pronounce favourably on their adoption.

Second: Methods of removal.

The principal methods resorted to for the removal of cancerous growths are:—The simple application of caustics; the use of caustics combined with the practice of incisions; excision by the knife; strangulation by ligature; and removal by the ecraseur.

The first-mentioned plan is of great antiquity, and easily employed. As escharotics, the following substances have all been used—the concentrated mineral acids, as the sulphuric and the nitric; the caustic alkalies, specially lime and potash; arsenic and various mineral salts, more especially the chloride of zinc.

The great objections to the use of these substances are the severity and the duration of the pain they occasion, and the frequency with which they must be repeated before the deepest layers of the tumours can be reached.

Of late years the chloride of zinc has been much used in the treatment of some cancerous affections; and there can be no doubt that, in some instances, it is an admirable application, and that its use accomplishes all that can be desired. Formerly it was made into a paste, by the addition of a very small quantity of water to render it liquid, and of as much flour as might be necessary to give it consistency; but now the chloride of zinc can be obtained in the form of pencil, like nitrate of silver and caustic potash; and in that form it is very convenient for use. After the application of the chloride of zinc, poultices must be applied to promote the separation of the slough, and the part afterwards treated as the common principles of surgery suggest.

The cases for which this method of treatment is suitable, are those in which the disease presents a considerable extent of surface compared with its depth—cases in which, though removal is desirable, excision would, from some circumstance, be hazardous; and cases of comparatively superficial cancerous or cancroid affections in patients who will not submit to operation. The use of this escharotic has been justly regarded as a valuable addition to the resources of the practical surgeon, and for my own part I prefer it to any other for the destruction of a cancerous tumour.

In cases where the use of caustics has been deemed advisable, the practice has recently been proposed, and in many instances adopted, of making carefully graduated incisions from time to time throughout the cancerous mass, in order to facilitate the penetration of the entire depth by the caustic appliances, and their pervading the whole of the morbid mass.

The method of removing cancerous growths most frequently adopted in this country, is excision. Interference by the knife is warrantable in cases where the tumour is solitary, and circumscribed, and where the lymphatic glands have not been secondarily affected, as well as in other conditions to be afterwards described.

When there are more tumours than one, when the cancerous cachexy is strongly marked, and when the whole of the diseased part, together with some of the surrounding tissue, cannot be removed, or when the period of lymphatic invasion has arrived, the surgeon should then restrict his interference to endeavours to palliate the disease which he cannot cure, and to diminish the urgency of distressing symptoms as they occur.

When it is considered judicious to use the knife in removing a cancerous growth affecting only part of an organ, the whole of the organ must be removed. In all cases, not only the whole of the tumour itself must be removed, but also a considerable portion of the surrounding tissue, lest cancer cells should have been infiltrated in the apparently healthy tissue: these, if allowed to remain, would ensure a return of the disease. In every instance, therefore, the surrounding tissue should be removed to a considerable extent along with the tumour; for, although it must be allowed that in very many cases, even with this precaution, the disease does return; without it, its return may be said to be a certainty.

It is equally important to resort to *early* excision, before the lymphatics have been invaded. Operative interference after the occurrence of lymphatic invasion could only bring discredit upon surgery, by subjecting the patient to a useless operation, followed by a return of the tumour; and, in all probability, in a form marked by increased rapidity of growth. The proper proceeding may, therefore, be said to consist in *early* and *free* excision.

Epithelial cancerous growths are sometimes so situated that they cannot be completely removed by the knife; and at other times, they are in parts where excision by the knife would occasion hemorrhage, which it would be most difficult and perhaps impossible to control. In such cases ligature may be used as a safe and effectual means of removal. The ligatures should be of strong cord, and applied so as effectually to strangle the part. Disadvantages of the ligature are the slowness with which separation of the sloughs takes place, and the annoying fœtor and discharge which accompany that process.

A more speedy removal of the cancerous mass may be effected by the ecraseur, an instrument invented by M. Chassaignac, and consisting of a loop of steel chain which is passed round the tumour, and is attached to a stem, by moving the handle of which it may be tightened to any amount. The diseased mass is quickly removed by this instrument, and the wound which results from its use, is usually small and easily managed.

The question now occurs, Does the excision of the tumour retard the fatal termination of the disease? The answer to this question varies according as the cancer is of the scirrhous, medullary, or epithelial form, and may best be answered by stating, first, the average duration of life from the first observation of the disease, in cases of each variety which have been allowed to run their own course; and then giving the average duration from the first observation of the disease, in those cases where operative interference has been resorted to. The observations of Lebert and Paget on this subject are extremely valuable.

It would appear that in the scirrhous variety of cancer, the average duration of life, when the disease is not interfered with, is a little more than 49 months; and that the removal of the local disease makes no material difference in the average duration of life. Thus Paget found that in 66 cases tabulated without selection, the average duration from the first observation of the disease was something more than 49 months; and in 47 cases in which the cancer was once or more frequently removed, the average duration of life was again something more than 49 months. Sometimes, however, the course of this form of the disease is much more rapid; and from Paget's observations, there is reason to believe that the course of the more rapid cases of the scirrhous variety of cancer is somewhat retarded by operation; for out of a certain number of tabulated cases, where death took place within two years, 36 per cent. were of those in whom the disease was allowed to run its course, and only 24 per cent. of those from whom the disease was once or more frequently removed.

In medullary cancer the average duration of life from the first observation of the disease, is scarcely more than one year where no operation has been performed; whereas the average duration of life of those patients, in whom the primary affection has been removed, is about 34 months, showing that the effect of removing medullary cancers is an increased average duration of life.

The average duration of life as ascertained from 38 cases of epithelial cancer is, according to Paget, 44 months; but he states that he believes the true average to be a little above this, probably about 4 years. In 30 cases collected by the last-mentioned authority 12 were not subjected to an operation; the remaining 18 were. The average duration of life in the former was 38·6 months and in the latter 39·3 months.

Therefore, a very trivial prolongation of life generally follows the removal of epithelial cancers; but still, in some cases, patients live a long time, and in a very few instances permanently recover from the disease, after operation.

The average duration of life in cases of melanotic cancer is pretty nearly the same as in cases of the medullary variety; and the rate of progress of the colloid cancer is, according to Lebert, rather slower than that of the medullary.

Another interesting question in the history of cancer is, At what periods after operation do recurrences of the disease take place?

In 74 cases collected by Lebert and Paget,* the following were the periods of recurrence after operation:—

Between	1	and	3	months	in	23	cases.
"	3	"	6	"	"	22	"
"	6	"	9	"	"	8	"
"	9	"	12	"	"	6	"
"	12	"	24	"	"	7	"
"	2	"	3	years	in	3	"
"	3	"	4	"	"	1	"
"	4	"	6	"	"	2	"
"	6	"	8	"	"	2	"

In 38 cases of medullary cancer Paget found the average period of recurrence to be seven months; and among 27 cases of epithelial cancer the periods of recurrence ranged from one to twelve months, and were, on the average, six months after the date of the operation.

The periods of recurrence of melanotic tumours are very nearly the same as those of the medullary variety.

The removal of a cancerous tumour incurs a certain amount of risk, from the consequences of the operation itself. In the case of the breast, Paget states that "in 235 operations for the removal of cancerous and other diseased breasts, I find 23 deaths; and probably this mortality of 10 per cent. is not too high an estimate, at least, in hospital practice." My own impression is, that this is rather too high an estimate of the mortality from the consequences of the operation itself. In 51 cases of removal of the breast, in hospital and private practice, I have seen but 2 deaths, and they were both from erysipelas; but the number of cases I have had under my own observation I am aware is too small to furnish sufficiently valuable information on this point.

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* See Paget, vol. ii. p. 347.

Seeing the impressions at present entertained regarding the ordinary duration of life in the different varieties of cancer, when allowed to run their course, and when the disease has been removed, and considering that an operation is itself attended with a certain amount of risk, important questions for consideration are—In what circumstances is an operation justifiable and proper, with the hope of adding to the duration or happiness of life? In what circumstances is an operation clearly unadvisable? And in what cases is its propriety doubtful? In the hope of adding to the duration of life, it may be performed in cases of acute hard cancer, and also in cancers where the local disease is destroying life by pain, profuse discharge, or mental anxiety, provided the disease be solitary, and unattended by cachexia. In cases of medullary cancer, when solitary and unattended with such cachexia as to render an operation hazardous, it may be performed with the hope of adding two years or more to the duration of life. And in epithelial cancer, when superficial in the lip; in soot cancer, not very rapid in its progress; and, especially in epithelial cancer of the lower extremities, after injury, and for which amputation is performed, there is reason to believe that life will be prolonged by removal of the local disease. In the above-mentioned states an operation may be recommended with the double object of adding to the duration, and increasing the happiness of life; but when we cannot indulge the hope of prolonging life, we are justified in advising an operation for the purpose of increasing the patient's happiness, in cases where it is not probable that the operation itself would shorten it. The patient is for the time freed from pain and from mental anxiety, and lives in hope, and in great comparative comfort; and when the disease does return, the suffering caused by the recurrent is less than that of the primary disease, when allowed to run its course without interference; and, besides, the patient has the comfort of knowing, when the disease is no longer capable of being removed, that all was done that could be done to retard its progress, and delay its fatal issue. The principal conditions which render an operation unadvisable, are—The constitutional cachexia being strongly marked, or disproportionate to the extent of the local disease; debility; intemperate habits; granular disease of the kidneys; or any state of the general health rendering the patient an unfit subject for a surgical operation; the existence of cancer in an internal organ; chronic cancer, especially in old persons; cancer so situated as to make perilous extent of excision necessary for its complete removal, along with a portion of uncontaminated tissue-lymphatic invasion; and epithelial cancer of the tongue, or other organs within the mouth. In all these states, and in all cases where the disease is destroying life more by cachexia or constitutional symptoms, than by the local affection, we are justified in withholding an operation. An operation is of doubtful propriety where the skin is extensively ulcerated, not that ulceration of the skin to a certain extent, other things being favourable, renders an operation inexpedient; where the neighbouring glands are so enlarged as to make it a matter of uncertainty, as to whether or not the whole of the contaminated, along with some surrounding healthy tissue, can with safety be removed; where the skin is extensively infiltrated; and where there is reason to fear that an operation would permanently weaken the patient, which would accelerate the progress of the constitutional disease.

Such as already stated are the slight varieties in the brief duration of the lives of patients affected with carcinoma, when the disease has been allowed to run its course, and when removed by operation; and, sooner or later such the uniform fatal result:—a history, progress, and result, in accordance with the experience of all surgeons, which experience establishes the fact that, with a few very rare exceptions, all persons operated upon for cancer die usually within a limited period from recurrence of the disease. Sir B. Brodie states, as the result of his experience, that it usually proves fatal in two or three years after the operation; and Sir A. Cooper found that in only nine or ten cases out of a hundred did the disease not return in three years. Some startling exceptions to the usual rule of progress are occasionally met with, to some of which we may refer. Paget alludes to some cases in which life was ended in four months, and some in which it was prolonged for twenty-four years. Gross, of America, mentions the case of a lad, a patient of Professor Post, in the New York Hospital, who had a large encephaloid tumor upon the scapula, from which he died in eight weeks from the period of its first appearance; and he refers to a lady, who was a patient of his own, in whom the disease had been regularly progressing for twenty years, and who had at one time been a patient of Sir A. Cooper. Velpeau states that he has removed cancerous tumours from patients in whom no return has taken place in 12, 15, or 20 years after extirpation. Sir B. Brodie, writing on this subject in 1846, states that—"So long ago as 1832, I removed a breast affected with a scirrhous tumour, and the lady is still in good health—at least she was so last year; since the operation she has married and had children. Last year I was called to see a lady on account of another complaint, on whom I performed the operation thirteen years ago, and found that she continued free from the old disease; and very lately I have heard of another lady, whose scirrhous breast I removed six years ago, and who continues well." Two remarkable cases have occurred in my own experience. Sixteen years ago I removed a scirrhous breast from one lady, who continues perfectly free from any return of the disease ; and thirteen years ago I performed the operation on another lady, who still continues well. The number of cases, however, in which the patient survives the operation for a longer period than the average duration is so small, as not to justify the grounding of any hope on them, or allowing them to influence the decision as to the proceeding to be advised in any single case.

CHAPTER IV.

ERYTHEMA AND ERYSIPELAS.

ERYTHEMA.

In this chapter it is proposed to give a brief but comprehensive account of the doctrines of Erythema and Erysipelas. To render the description more clear, we shall refer to the different varieties of those affections, stating their symptoms and causes, together with the circumstances under which they are usually met with, and their treatment.

Erythema—from ἐρύθημα, redness—is a term to which all writers have not been careful to affix the same signification. Hippocrates used it to denote any kind of morbid redness of the skin; at a subsequent period Celsus, and still later Galen, substituted the term erysipelas for erythema: and this has, no doubt, occasioned part of the confusion which has arisen in the use of the term; some employing it as synonymous with idiopathic erysipelas, others as designating the slightest grade of erysipelas; while there are those who, as J. P. Frank, and J. Frank, have applied it to several affections of a chronic kind, perfectly distinct from those to which it has been given by recent British and French pathologists.

Erythema, in the sense in which the term is generally employed in this country, may be defined to be a superficial redness of the skin, disappearing momentarily on pressure; usually of an acute character, and not infectious; attended with a burning pain, tenderness, and dryness of the part; and generally unaccompanied with vesication, or with swelling beyond a slight and barely perceptible degree. On the subsidence of the inflammation the part is covered with scales, in consequence of desquamation of the cuticle.

The idiopathic, or primary, or local, form generally proceeds from some topical irritation, as friction, attrition of contiguous surfaces, pressure, irritation caused by morbid secretions, by vicissitudes of temperature, by chemical or mechanical irritants, or by stings of insects. Even this form of erythema, although caused by topical irritation, is favoured by, and almost always more or less associated with, disorder of the digestive, excreting, or eliminating organs. The increased action very rarely rises beyond the grade of active congestion; and the slight form of the local affection, its non-extension to the cellular tissue under the skin, and the very limited amount of constitutional disturbance, sufficiently distinguish erythema from erysipelas.

In this form the proper local treatment consists in the removal of the cause of irritation, rest, an attitude favourable to venous return, and fomentations ; and should these prove insufficient, in pencilling over the part with a strong solution of the nitrate of silver. Rest, restriction of diet, and a few gentle alterative aperients, constitute the general treatment ; and for preventing the return of the disease, the most important precautions are, to avoid exciting causes of the affection, and to use proper means for regulating the functions of the stomach, the liver, and the skin.

The sympathetic erythema of Rayer may be said to comprehend the different varieties enumerated by Willan and Bateman. These are the six following :—*erythema fugax*, which appears upon the breast, arms, and face, in cases of bilious diarrhœa, in certain affections of the alimentary organs, and in various febrile disorders : *erythema læve*, which is most frequently met with as an accompaniment to anasarca or œdematous swellings, but occasionally attends the catamenia in weak and irritable females, and is sometimes symptomatic of disorder of the digestive system : *erythema marginatum*, which, deriving its name from being bounded on one side by a hard elevated border, occurs chiefly in old persons in the progress of some internal disorders, and is always regarded as an unfavourable symptom : *erythema papulatum*, sometimes attended with general disturbance of a slight nature, but frequently with anorexia and much prostration of strength : *erythema tuberculatum*, a very rare variety attended with great languor, irritability, and restlessness, and succeeded by hectic—which Bateman never met with, and of which Willan saw only three examples : and *erythema nodosum*, which shows itself in vivid patches on the foreparts of the legs, mostly in young females of a relaxed constitution ; is preceded by slight febrile symptoms ; and is sometimes connected with the approach of the catamenia.

Rayer mentions another variety which other observers have overlooked—*general erythema*. A case came under my notice some time ago, which I believe was an example of this variety : the pulse was rapid and feeble, the redness pretty general over the body, prostration of strength great, the tongue dry, and the bowels very loose ; it continued nearly a week, and was followed by desquamation.

The different varieties of symptomatic erythema must all be treated by internal or constitutional remedies, and according to indications furnished by the internal disorders which they are found to accompany.

ERYSIPELAS.

Names and Definition.—Erysipelas, derived from ἐρύω, *I draw*, and πέλας, *adjoining*, so named from its tendency to spread to the adjoining parts of the skin, may be defined to be, inflammation of the skin and subjacent cellular tissue, characterized by a deep red tint, by swelling of the parts affected, and by a remarkable tendency to spread by continuity. It is also called the Rose, from the colour of the integument, and St. Anthony's Fire, a name given to it in former ages on account of the burning heat which accompanies it, and from the superstitious belief that St. Anthony had special power to heal this kind of disease.

Divisions.—The varieties of erysipelas have been very differently divided by different writers. Some have proposed a division according to the region in which the disease appears:—1st, Erysipelas of the face and head; 2nd, Erysipelas of the trunk; and 3rd, Erysipelas of the extremities. Burserius suggested a division according to the supposed causes:—1st, Primary, or Idiopathic, when it arises from an internal disease not preceded by any other; 2nd, Secondary, or Symptomatic, when it supervenes on another disease; and 3rd, Accidental, when excited by some obvious external cause. Biett and Cazenave divided them into True and Phlegmonoid; Alibert and Rayer into Simple, Phlegmonous, and Œdematous. The division employed by Willan and Bateman was into Phlegmonous, Œdematous, Gangrenous, and Erratic; and that by Desault into Phlegmonous, Bilious, and Local. We shall refer to the following varieties:—1st, Simple; 2nd, Phlegmonous; 3rd, Œdematous; 4th, Bilious; 5th, Erratic; and 6th, Periodic.

SIMPLE ERYSIPELAS.

Symptoms.—Simple, called by some authors true or legitimate erysipelas, is characterized by the following symptoms:—Redness of the skin, more or less vivid, occasionally partaking somewhat of a livid, and in many instances of a yellow tint; disappearing under the pressure of the finger, but returning on its removal; and defined by a distinct elevated margin, which irregularly circumscribes it; slight tumefaction, never acuminated or convex; and pain of a tensive, peculiar, or stinging character, accompanied by itching, and a sense of burning diffused over the whole inflamed surface. For three or four days these symptoms continue to increase in intensity, and then begin to decrease, remaining, however, in some degree for three or four days longer. When the inflammation is acute, small miliary vesicles, like those of eczema, are developed on the inflamed skin, and when it is very intense, bullæ or phlyctenæ often appear on the erysipelatous part. These bullæ may be isolated or confluent; they burst soon after their appearance, most frequently about the fifth or sixth day of the disease, and the humour they emit dries on the skin, forming flavescent crusts, which afterwards become brown or blackish, and ultimately are detached along with the epidermis, which falls off in scales.

The local symptoms usually make their appearance after certain precursory signs, such as languor, lassitude, depression, shiverings, general uneasiness, nausea, and very frequently other manifest symptoms of disturbance of the functions of the alimentary canal. The constitutional symptoms take the precedence for some time; then the local symptoms appear, and afterwards they increase and decrease together. It has, however, been correctly remarked by careful observers, that the local disorder is by no means invariably in the direct ratio of the severity of the febrile symptoms.

Results.—The most frequent and most favourable result of this form of erysipelas is resolution; slight discoloration and thickening of the skin, together with desquamation of the epidermis, remaining for a very short time, and then disappearing. In the mildest form there is scarcely any desquamation, but in more acute cases it is considerable, and slight thickening of the skin and discoloration remain for a short time; and if the action be still more intense, serous effusion may take place, both on the external surface of the cutis, constituting bullæ or phlyctenæ, and in the subcutaneous cellular tissue which becomes infiltrated. By the absorption of the fluid in the cellular tissue, and the bursting and desiccation of the vesicles on the surface, all traces of the disease disappear. At a certain stage, in some cases, the part is found to be covered over with dry cuticle, and in others, where bullæ have formed, with crusts. Sometimes, though very rarely in this form, and only when the action is very acute, the inflammation proceeds to the extent of suppuration, forming abscesses; the matter in such cases being surrounded by a fibrous cyst, does not constitute diffuse suppuration, which condition is met with in a more serious variety of erysipelas. Although abscess is comparatively unusual, as an immediate result of this simple form of the disease, it is by no means uncommon for persons of a feeble and irritable constitution to have inflammation excited in a part recently the subject of erysipelas, or in its immediate neighbourhood; and for that inflammation to go on to the formation of abscess, requiring very early and free evacuation, in order to prevent destruction of tissue.

Sometimes the inflammation suddenly disappears, and presents itself in some other part of the external surface, constituting erratic or ambulant erysipelas; and sometimes, although more rarely, its sudden disappearance is followed by asthenic inflammation of some internal part, constituting metastatic erysipelas.

Causes.—The causes of erysipelas are various, and sometimes very obscure. The chief predisposing causes are intemperate living, especially in regard to spirituous liquors, unwholesome or insufficient nourishment, the bilious and irritable temperaments, the gouty diathesis, previous disease, general cachexia, low spirits, anxiety, the feeble, plethoric, and leucophlegmatic habits, disordered condition of the biliary and digestive organs, certain seasons of the year, more especially spring and autumn, irritability or tenderness of the skin, feeble capillary circulation, previous attack of the disease; and in females, derangement of the uterine function, and certain periods of life, as that of menstruation, and that of the cessation of the catamenia. Certain diseased states of the blood predispose, in a remarkable degree, to the supervention and the severity of erysipelas. This is strikingly exemplified in diabetes and in granular disease of the kidneys, attended by albuminuria. In this last-mentioned state, erysipelas may occur from the most trivial causes, and when once set up, spreads in a most uncontrollable manner, giving rise to extensive sloughing and suppuration of the affected tissues; there not being sufficient power in the system for the deposition of plastic matter and the limitation of the inflammation. Of the many exciting causes some act locally, as wounds, contusions, trifling injuries, surgical operations, abrasions of the cuticle, irritation caused by morbid secretions, or by leech-bites, by cold, by friction of clothes, by acrid or irritating substances of any kind, or by inflammation of the skin, from whatever cause proceeding. Of the exciting causes which originate in the system itself, and of those which act on the system generally, some are errors in diet, violent mental emotions, suppression of accustomed secretions or discharges, living in an unwholesome atmosphere, more especially in cold, damp, stagnant situations, atmospheric vicissitudes, impure air from the crowding together of patients in hospitals, contagion, and particular conditions of the air, in consequence of which it occasionally assumes an epidemic character, and is in such circumstances usually very severe and frequently fatal.

In those who have charge of the sick, few thing are more important to be constantly kept in view, than that erysipelas and other diffuse inflammations are extremely apt to be induced by want of attention to the hygienic conditions that should surround a patient. One of the most essential conditions for the welfare of the patient is, "to keep the air he breathes as pure as the external air, without chilling him." Erysipelas, fever, dysentery, diphtheria, are some of the many sorrowful fruits of impure air; and the results are the same whether the foul air be caused by want of ventilation, want of cleanliness, the presence of articles capable of giving off noxious effluvia, or by the admission of air from damp situations, or from localities where the air is loaded with impurities.

Erysipelas no doubt comes on in many instances without any obvious cause, but that it often spreads by means of contagion, has been proved by incontestable evidence. There seems also to be good ground for believing, that erysipelas originating in some common cause, and erysipelas induced by local causes, may spread by means of contagion. Most of the French authorities deny that erysipelas is transmissible by contagion; but that it is so, facts recorded by Wells, Stevenson, Arnot, Gibson, and Lawrence, in various interesting papers published by them on this subject, furnish most conclusive evidence, and set this question at rest. Many other cautious observers have arrived at the same conclusions as the authorities I have mentioned. Many cases adduced by Coupland, Travers, Nunnceley, and Bright furnish convincing proof of the contagious character of erysipelas.

An excellent author observes:—"Erysipelas may not only spread from patient to patient, but any diffuse inflammation, as phlebitis, inflammation of the absorbents, low or puerperal peritonitis and pyemia may give rise to external erysipelas, and in its turn be occasioned by it—a strong argument in favour of the allied nature of all these affections. Then again, the contact of dead or putrescent animal matters with recent wounds may occasion it. In this way the disease is not unfrequently originated in hospitals by dressers going direct from the dead house, and especially from the examination of the bodies of those who have died of diffuse inflammation, to the bedside of patients without taking sufficient care to wash their hands or change their clothes. For this reason also it is of great consequence that the same instruments be not used for practising operations on the dead, and performing them on the living body."

PHLEGMONOUS ERYSIPELAS.

This disease, although met with at all periods of life, and in all parts of the body, is much more commonly found in young and plethoric than in elderly persons, and more frequently in the extremities than in the other regions of the body. This is a very dangerous form of the disease, especially when it occurs epidemically, or from infection. Both the local and constitutional symptoms are severe; the inflammation not only has its seat in the skin and subcutaneous cellular tissue, but frequently extends also to the deeper portions of cellular tissue between the muscles. To make the description of this disease more clear, we shall adopt the arrangement of those authors who divide it into three grades, differing from each other in the degree of their intensity.

In the first grade, after rigors, anxiety, and other symptoms of constitutional disturbance, soon followed by stinging pain, tingling, redness, and a feeling of heat of the inflamed part, tumefaction of rather a hard character takes place, occasioned by the integument being raised up by swelling of the subjacent cellular tissue. After pressure with the finger, the redness returns more slowly than in the simple and superficial form of erysipelas. If about the fifth day, the skin is observed to be less red and tense, and to be covered with furfuraceous scales, and the subsidence of the swelling shows that the subcutaneous cellular tissue is beginning to regain its usual state, the phlegmonous erysipelas will end in resolution. But if, on the contrary, the pain at this stage becomes pulsatory, suppuration is the inevitable result, the matter forming into an abscess of healthy character, the opening of which is usually followed by the speedy healing of the part.

In the second grade, both the constitutional and local symptoms are much more severe; the disease occupies a large extent; at a variable period, but generally not before the fifth nor after the ninth day, purulent collections form beneath the skin or between the muscles, and, on their being opened, gangrenous masses of the cellular tissue are discharged along with the matter. Often, instead of abscesses, there is extensive sero-purulent infiltration into the cellular tissue. There are many sources of danger in this variety, some of which are great irritability of the stomach and bowels, exhaustion from diarrhœa or from extensive suppuration and disorganization of the cellular tissue, severe nervous symptoms, contamination of the blood from absorption of the morbid secretion of the affected part, or combinations of these conditions.

In the third grade, the constitutional and local symptoms are still more intense from the commencement; the skin is tense, shining, and of a dark dusky red, and only retains, for an instant, the impression made by the finger; the swelling is diffused, very great, and intolerant of pressure. About the fifth or sixth day, the skin loses its sensibility, assumes a violet tint, and becomes flaccid and covered over with phlyctenæ containing a reddish serosity, and, soon afterwards, sloughs are formed along with ichorous suppuration, destruction, and suppurating boils in the surrounding cellular tissue. This is what some authors call gangrenous erysipelas. In the most favourable cases, after the sloughs are detached, the subjacent parts take on a healthy action, and, after a considerable time, the part granulates and cicatrizes: but most frequently, from absorption of matter or inflammation of veins, or some affection of the brain, stomach, or bowels, the patient sinks, the precursor of death being the symptoms of the worst form of adynamic fever.

ŒDEMATOUS ERYSIPELAS.

In this form the skin is smooth, shining, and of a pale red colour, which, in some instances, inclines somewhat to a yellowish-brown; the heat and pain are less than in the other forms; the swelling is considerable, and gradually extends; it leaves the impression of the finger as in anasarca, and from this circumstance this variety has received its distinctive appellation. Vesication is less common than in the other varieties, and, when it is present, the vesicles are small and numerous. The inflammation is of a sub-acute character, and gives rise to serous effusion; in some situations it is apt to result in gangrene, as when it occurs in dropsical limbs from excessive distension, or when punctures have been made to allow the fluid to drain off. To diminish the risk of the occurrence of gangrene, in such circumstances, some have judiciously allowed the fluid to escape by numerous punctures with a needle, rather than by incisions.

This form of erysipelas is in degree intermediate between the simple and phlegmonous, and most commonly presents itself in persons of a debilitated constitution, and very frequently in those who are affected with dropsy, or have a tendency to it. The infiltrated limbs of dropsical patients, the scrotum in men, and the genitals in women, are the most usual seats of œdematous erysipelas; and, of all the results of this variety, gangrene is the one most to be dreaded, and is indicated by severe pain, and a red, glossy state of the skin passing into a leaden or lurid hue.

BILIOUS ERYSIPELAS.

Antecedent disorder of the digestive and assimilative organs is more or less evident in all the forms of erysipelas; but in this form symptoms of bilious derangement, both before and during the attack, constitute the most prominent features. In such cases, the local symptoms are far from urgent; the redness partakes much of a yellowish hue, and all the local signs indicate but a slight grade of inflammatory action. The constitutional symptoms also exhibit a very moderate degree of the inflammatory type; the principal being nausea, bilious vomiting, loathing of food, thirst, loaded tongue, a yellowish tinge of the body, and other manifest signs of disordered secretions in the primæ viæ.

ERRATIC ERYSIPELAS.

The peculiarities of this form are—that it invariably presents itself in persons of a feeble or debilitated constitution; that the constitutional symptoms precede and attend the attack; and that they are much more of the asthenic than of the sthenic character, the symptoms of debility usually becoming very apparent; that the local symptoms are even less severe than is usual in ordinary cases of simple erysipelas; that, in most instances, exfoliation is the only effect remaining; and that the inflammation spreads from one part to another by continuous unbroken extension, the circumference of the inflamed part being always distinct, so that it is very evident where the inflamed and unaffected parts of the skin join each other.

PERIODIC ERYSIPELAS.

The peculiarity of this form is not merely that it returns, but that it is sometimes strictly periodical, returning more frequently, so far as my observation has enabled me to form an opinion, to the parts which were previously attacked; in some instances it has been found to be periodical in return, and universal in extent—that is, extending over the whole body; an example of which occurred in the experience of Mr. Maul, of Southampton, in the case of a lady who had several attacks at intervals of two years. In some instances the attack is monthly, at the time the catamenia should appear. This form of erysipelas is, I believe, most frequently met with in females of a weak and chlorotic habit. I have a patient who, for some years, had a return of it every six weeks, but got over the tendency by residence in the country, and the use of suitable remedies for the improvement of her general health and strength. I know an instance of a man who had for years an attack every two months. In both the last-mentioned cases, the head was the part attacked. One man, whose case I remember, had an attack regularly twice a-year, and another every spring. The local symptoms, so far as I have had opportunity of observing, are not very severe, and rarely give rise to more than œdema of the cellular tissue, and exfoliation of the cuticle. The constitutional symptoms are both antecedent and attendant.

TREATMENT OF ERYSIPELAS.

From what has been stated regarding the various forms of erysipelas, the different states of the system in which they take place, and the varieties, both as to the degree of the inflammatory action, and as to the degree and type of accompanying fever, it must be very clear, that it will be necessary to modify the treatment according to the particular circumstances of each form and case. Some cases require little treatment beyond rest, suitable regimen, and a proper attitude of the inflamed part; in some, purging and the antiphlogistic regimen are needful; in some, local remedies of a decided character must be joined to general antiphlogistic treatment; while others are attended with so much of a typhoid type, as to require the use of remedies of a very different nature. It has been observed:— "In some instances large depletions are required; in others, moderate or local depletion only is advisable; and, in many, depletion is most injurious, the most energetic tonics being often indispensably necessary." Whilst the disease thus requires, from the very commencement, most varied and often opposite modes of treatment, it frequently, also, demands an almost equal diversity at different stages of its progress.

In simple erysipelas, the general treatment in slight cases consists in the observance of the antiphlogistic regimen, and the exhibition of mild purgatives, together with rest, pure air, and the maintenance of a proper attitude; but in more severe cases, emetics, purgatives, and antimonials are to be employed; and, in all instances, it is important to begin with what Dr. Todd calls eliminative treatment, in other words, to promote the excretions by which the blood is naturally purified. With reference to depletion, great regard must be paid to the powers and habits of the patient, the stage of the disease, and the prevailing character of the epidemic. Of the many cases which have come under my own observation, there are very few in which I have thought general bleeding necessary, or at all likely to be serviceable; and, except in some very severe cases of erysipelas in the head and face in young and vigorous persons, I have never resorted to it. Even in such cases, and in others where, from the exceedingly acute character of the symptoms, depletion may be deemed prudent, it should be employed with much circumspection; for however strong and hard the pulse may be, or however great the heat and the urgency of acute inflammatory symptoms, there is soon, in most cases, a tendency to asthenic vascular action and deficiency of vital powers. It is, therefore, judicious in most instances to rely on other means for allaying excited action, and to resort to bleeding only when it seems absolutely indispensable. In most cases rest, an emetic, mercurial or other purgatives, followed by antimonials, and aided, of course, by suitable regimen, fulfil the desired indications, which are, to correct the secretions in the alimentary canal, to promote the secretions generally, and thereby to diminish inflammatory action and febrile excitement. As the indications of treatment often alter very quickly, cases should be watched with the greatest care, and the treatment changed, if symptoms of debility present themselves. If any doubt exist whether it be desirable to administer decided stimulants, beef-tea may be given, and four or five grains of carbonate of ammonia every two or three hours; and if the symptoms should not improve, then wine may be administered, and the bowels regulated by mild aperients, but not by drastic purgatives.

The following extract from Mr. Liston, as to the means recommended for subduing inflammatory action in erysipelas without resorting to bleeding, will be perused with interest:—

"The exhibition of the extract of aconite in this and other inflammatory affections, is often followed by great abatement of vascular excitement, so that the necessity for abstraction of blood is done away with. The medicine may be given in doses of half a grain in substance, or dissolved in pure water, and repeated every third or fourth hour. The sensible effect is relaxation of the surface, and frequently profuse perspiration; the arterial pulsations are diminished in frequency and force. The extract of belladonna, in doses of 1-16th of a grain, may then be substituted with great advantage, and often with the most extraordinary effect upon the disease." Cases of erysipelas thus treated in the North London Hospital are published in the "Lancet" of 6th and 13th of February, and 16th of April, 1836.

In the "Monthly Journal of Medical Science" for June, 1851, there appeared a communication from Mr. Hamilton Bell, on "the treatment of Erysipelas by the Muriated Tincture of Iron," with some remarks in its favour, by his brother, Dr. Charles Bell, who had also for some time adopted the remedy with great success. Mr. Bell remarks :—" In order to explain in some measure the principle by which I have been actuated in employing a powerful tonic in a disease generally occasioning so much fever and cerebral excitement as erysipelas, I consider it necessary to repeat the opinion I have elsewhere expressed," viz., that "in inflammation, the capillary vessels having apparently lost the power of separating or electing the component parts of the blood which are necessary for functional purposes, and become to a certain extent inert tubes, a stream of blood is admitted, for the circulation of which they are not calculated."

With regard to his mode of employing the remedy, Mr. Bell remarks :—" Of course the first object is to have the bowels freely acted on. If the erysipelas be mild, fifteen drops of the muriated tincture of iron are administered in water every two hours, until the disease is completely removed. When the attack threatens to be more severe, the dose of the tincture is increased to twenty-five drops every two hours, and persevered in night and day, however high the fever and delirium. The only local applications I ever find necessary, are hair powder and cotton wadding. While I depend for the removal of the disease on the chalybeate, it is necessary that the bowels should be attended to throughout the treatment."

After reading Mr. Bell's paper, I resolved to give the remedy a fair trial. Since that time I have employed it in a sufficient number of cases to warrant my speaking confidently of its efficacy. I have found it a most useful remedy in cases of erysipelas occurring on the trunk and extremities ; but I have been more especially struck with the beneficial results consequent on its employment in erysipelas of the head and face, in all which I commenced to use it, immediately after rectifying the various secretions, irrespectively of the degree of fever or of the violence of the head symptoms. In all cases it is most necessary to pay careful attention to the state of the bowels. In the case of those who were subject to periodic attacks of erysipelas, I have observed that the muriated tincture of iron not only shortened the duration and diminished the severity of the attacks, but also evidently prolonged the interval.

Local treatment.—In mild cases no local treatment is required beyond rest, and an attitude favourable to venous return. In others local applications are useful. Of all the applications in use, my experience leads to the conclusion, that the most generally grateful to the feelings of the patient, and the most useful, are warm opiate fomentations, or opiate and lead lotion, applied as warm as the patient can bear them, and as long as he finds them pleasant to his feelings.

Sometimes, though very rarely, warm applications are painful; and then I do not hesitate, if the erysipelas be in the extremities, to use the above applications cold, and if they give relief, to continue their use as long as they prove a comfort to the patient.

In more urgent cases, when the action is very acute, I have, together with the use of warm applications, adopted, with the happiest results, the mode of proceeding which was proposed by Dobson, and has been much and deservedly praised by many, namely, local depletion by numerous small punctures, rapidly made with a fine lancet. The punctures should extend only into the true skin, and should be made rapidly. Of the advantages of this proceeding, in acute cases, I can speak in the strongest terms, patients having often expressed themselves grateful for the relief it has afforded. Other local remedies, used in many cases with much advantage, are, brushing over the part with a strong solution of the nitrate of silver, as recommended by Higginbotham, and practised by many; or lightly touching the inflamed surface with the lunar caustic in substance. The former mode is that which I have usually preferred, and my experience leads me to speak very favourably of it, especially in erysipelas of the extremities. After brushing over the part with a strong solution of the nitrate of silver, dusting the surface with flour or magnesia, or keeping it fomented with warm opiate, or lead and opiate lotions, or applying them cold, when warm applications are not grateful, are proceedings from all of which, in my own experience, I have seen the happiest results. I am satisfied, from my own observation, that Higginbotham, Jobert, and others, were fully justified in speaking so strongly as they have of the advantages of using the nitrate of silver as a local application in the treatment of erysipelas. In cases of erysipelas of the face, it is often found exceedingly useful to brush over the part with a concentrated solution of gutta percha in chloroform. Of the advantage of keeping the part covered with mercurial ointment, as proposed by Little and Dean, of America, or of the application of a lotion, or ointment of the sulphate of iron, in the proportion of a drachm of the sulphate of iron to a pint of water or an ounce of lard, as recommended by Velpeau, principally in cases where there are no vesications, and where the inflammation is superficial, I can say nothing from my own observation. To the use of blisters, first recommended by Dupuytren, I have *rarely* resorted, and to bandaging *never*, except as a means of support when all inflammatory action has ceased; but some continental surgeons have adopted a proceeding, which, so far as I know, has never been followed in this country, and which must surely be attended with great risk, namely, bandaging from the very commencement of the attack, even when the action is acute.

In phlegmonous erysipelas, the constitutional and local treatment, in the first instance, differs in no respect from that proper for severe cases of simple erysipelas; but it must be strictly kept in view, that, whatever may be the activity of the symptoms in the early stage, the general powers are weak, that the disease not unfrequently occurs in those whose powers are naturally feeble, or in persons advanced in life, and that, although accompanied with excitement in the early stage, it is afterwards marked by impaired energy, so that if the powers of the patient be greatly exhausted, he will be in the greatest possible danger of sinking under the process of suppuration and sloughing. The most important part of local treatment is the employment of incisions, which, though suggested centuries ago, was first practised in this country by Mr. Copland Hutchison, and has been strongly recommended by him, by Mr. Lawrence, and by many others, and is well worthy of general adoption. Mr. Hutchison recommends that the incisions be made about an inch and a half in length, from two to four inches apart, varying in number according to the extent of surface occupied by the disease. Mr. Lawrence recommends, in preference to numerous incisions, one or two of some length in a direction parallel to the axis of the limb. Much difference of opinion has prevailed, as to which of these recommendations should be followed; but, on this point, the judicious course is, while careful to confine incisions to parts where the erysipelas has the phlegmonous character, and avoiding all unnecessary division of parts, to proportion both the number and the depth to the extent of the inflammation; and a very important rule is, to divide fasciæ, provided the inflammation extend beneath them. The treatment by incisions is adopted at different stages of the disease for the attainment of different objects. At the beginning of the disease it is employed with great advantage, and is often very quickly followed by relief of the painful tension, and a corresponding diminution of the inflammatory action, thus preventing the occurrence of suppuration and sloughing. In short, suffering is mitigated, and tissue is spared, by the energetic adoption of this proceeding at an early stage. The local depletion is useful, the liquor sanguinis is allowed to escape before its disorganization has taken place, and disastrous results are averted. At a more advanced period of the disease, incisions limit the extent of suppuration by opening a way for the evacuation of matter, and still later, they afford the readiest outlet to matter and sloughs. At this advanced period, however, they must be made sufficiently deep to reach the whole of the infiltrated and gangrenous structures; otherwise they cannot fulfil the important indications for which they are employed. Fomentations, in the first instance, and afterwards poultices, should be applied over the part. The patient should be watched, until all bleeding has ceased, as it may be necessary to resort to some proceeding, such as elevation of the limb, or slight pressure for a few minutes, or to tie some bleeding vessel, to prevent the hemorrhage from becoming excessive and injurious.

The general strength requires to be kept up by generous diet, wine, quinine, and other suitable means, during the severe trial to which it is subjected under the process of suppuration and granulation.

In almost all cases of this class the use of powerful opiates is absolutely required at no very advanced period of the disease, for soothing pain, procuring sleep, allaying constitutional irritability, preventing exhaustion, and affording time and opportunity for the efficient action of other remedies.

In œdematous erysipelas, the constitutional treatment, in the first instance, consists in promoting a healthy condition of the secretions, by the employment of mild aperients with suitable regimen, and subsequently, in improving the general health and strength, by the use of a light, nutritious diet, and by all the means suitable and available in the circumstances. In most instances, as the case progresses, quinine will be indicated. The local treatment consists of rest, elevation of the affected part, warm fomentations, small punctures to allow the escape of serous effusion, and, at a not very advanced stage of the disease, support by means of bandages.

In bilious erysipelas, if the head be not severely affected, and the disease be unattended with much pain or tenderness at the epigastrium, an emetic given at the commencement of the attack is usually of service; after the operation of which, a smart dose of calomel, followed by smart purgatives and diaphoretics, is of great benefit. The subsequent constitutional treatment must be regulated according to the character of the disease, the states of general and local vascular action, and the condition of the vital powers. If there be much tenderness of the epigastric or hypochondric regions, together with nausea or vomiting, local depletion in the vicinity, and afterwards blisters or sinapisms, are of essential service. Little local treatment is required beyond rest, and an attitude favourable to venous return; the local, as well as the constitutional symptoms, being chiefly combated by internal remedies.

CHAPTER V.

BURNS.

A BURN is an injury inflicted on the body by a degree of heat higher than is compatible with healthy action in the part affected. Burns are produced either by actual contact with flame or heated bodies, or by radiation of caloric from them; and their severity depends on the proximity and intensity of the heat, the length of time it has been applied, and the nature of the heating agent, as also that of the injured part. Thus, flame, which can exist only at a very high temperature, and which speedily induces combustion of the tissues; steam, whose latent heat becomes sensible on condensing; metals, whose density and conducting power are great; and oil, which maintains a high boiling point, and adheres to the skin;—all produce severe burns, which, *cœteris paribus*, are more severe on those parts where the epidermis is thin and delicate. This condition, when produced by heated liquids or vapours, is usually styled a *scald*, the term burn being then restricted to those cases where a dry body has been the agent of injury. As the heat of solid bodies is frequently much greater than that attained by fluid substances, except metals in a state of fusion, the former may produce very deep burns; while liquids, by flowing over a large surface, cause more extensive, though comparatively superficial lesions.

The classification now generally employed, as being the most scientific and convenient, is that of Dupuytren, who arranged all burns into *six classes* or *degrees*; the tissues involved, and the amount of lesion being made the basis of classification. The *first* degree consists of a superficial inflammation of the integuments, *un*attended by vesication. The *second*, in addition to the rubefaction, is accompanied by vesicles. The *third* exhibits the skin partially disorganized, the cuticle, together with the papillary surface of the cutis, being destroyed and converted into a thin eschar. In the *fourth* degree, the whole thickness of the skin, including, sometimes, the subcutaneous cellular tissue, is carbonized. The *fifth* degree differs from the preceding only in penetrating more deeply; an eschar being formed which comprehends the several soft tissues beneath the integument, down to a variable depth, perhaps even to the bone itself. In the last or *sixth* degree, the whole thickness of the limb or part is carbonized.

Consequences of Burns.—If at all severe or extensive, this kind of injury is liable to be followed by many serious consequences, which though generally more or less combined in practice, may, for better description, be divided into two orders, namely—Local and General; or, into Inconveniences and Dangers; the former affecting simply the comfort of the patient or his limbs—the latter being dangerous to life itself. By a due knowledge and consideration of these, the treatment and prognosis must in every case be regulated. The first order, which consists of those *local* effects not directly dangerous to life, consists, with a single exception, of various conditions attending cicatrization, and productive of functional lesions, partial or complete. They have been enumerated under the heads of adhesions, deformities, and mutilations; to which may be added disfigurements, and affections of the cicatrix. The *disfigurements* consist of those unseemly cicatrices, especially on the face, neck, and other exposed parts, which merely affect the appearance rather than entail any serious discomfort. They are produced principally by burns of the third degree, by slight cases of the fourth, and sometimes, also, by severe instances of the second, when the epidermis forming the vesicles has been torn off, exposing the cutis to the stimulus of the atmosphere, to irritation, and subsequent suppuration. The *adhesions* imply those conditions in which, during cicatrization, contiguous tissues or surfaces, which in their natural state move freely on each other, have become mutually adherent, thereby abridging voluntary motion, as when a cicatrix adheres firmly to a muscle, tendon, or aponeurosis beneath; or these latter to one another. *Deformities* are constituted by any considerable alteration in the shape of an organ, or in the relation which one part naturally bears to another. They may be produced in two ways; either by contraction of the cicatrix, or by destruction of muscular antagonism. The cicatrix following a burn is said to have a greater tendency to contract, than after any other species of injury. Like all new and lowly-organized structures, it is very liable to absorption, which makes the contraction and puckering of the tissues around go on long after the sore has healed. Wherever a portion of skin has been destroyed in this manner, as in a burn of the fourth degree, its place is eventually supplied, not altogether by a new and permanent structure, but to a very considerable extent by the uninjured integument in the neighbourhood. This, by the steady drag exercised on it by the gradual contraction of the cicatrizing ulcer, or the cicatrix, is drawn together towards a central part, which is at last occupied by the cicatrix, now much diminished in size, shrivelled, and sometimes almost of a horny texture. The surrounding integument stretches to a certain extent, more especially in those parts where it is loosely connected with the tissues below; but if the loss has been very extensive, the requisition on the integument around will be proportionately large, and this demand may prove more than its extensile qualities can supply. Accordingly, if a burn be so situated that flexion or other posture of a neighbouring articulation will relax the skin around the seat of injury, the steady drag on the integuments, added to the natural tendency of the limbs to preserve a slightly flexed position, will produce, if not guarded against, a permanent flexure of the joint. The same remarks apply with still more force when the deeper-seated parts have, as well as the skin, been destroyed. Thus the fore-arm has been immovably bent on the arm, the latter bound to the side, the lower jaw dragged down to the sternum, and the head drawn back between the shoulders. When the injury is situated on the extensor aspect of an extremity, the tendency, above mentioned, of the limbs to sustain a slightly bent position, is in general sufficient to counteract the extending force of the contracting cicatrix. This is not, however, always the case, for the fingers have frequently been bent backwards upon the metacarpus, and the foot has been so twisted and deformed, that all trace of its original conformation has been destroyed. Deformities from this cause, and to this extent, are now, however, much less frequently met with than formerly; though, in injuries of such a nature, the motions of the joint almost always remain more stiff and constrained than natural, and are farther restricted by the abnormal adhesions formed between the cicatrix and the subjacent parts. Again, in those cases where the tissues beneath the integument are destroyed, as in a burn of the fifth degree, in which the continuity of muscles, tendons, or aponeuroses has been interrupted, the contractions of the cicatrix, together with the unnatural adhesions, frequently cause deformity, fixation, and even dislocation of a neighbouring joint. As in other injuries, when the solution of continuity affects a nerve, loss of voluntary motion or of sensation must ensue in the parts supplied by it on the peripheral side of the injury, by which occurrence the antagonism of two sets of muscles may be destroyed, and deformity produced. *Mutilations* consist in the partial or complete loss of an organ. They are immediate in all burns of the sixth degree, and in those of the fifth, in which the possibility of saving an useful limb is at once rendered hopeless. They are consecutive, when caused subsequently either by the violence of inflammatory re-action inducing extensive gangrene, or where the limb, as it remains, is so utterly useless as to necessitate amputation; an operation which is also sometimes necessary to save life when it is endangered by hectic from the exhausting effects of profuse and prolonged suppuration. The *affections of the cicatrix* are chiefly excessive contraction, fissure, ulceration, and irritability. As it is less highly organized than the original integument, it is peculiarly liable to the first three of these conditions, in conformity to the general law, that newly-formed and lowly-organized structures are much more prone to absorption, to inflammation, and other diseases, than older and more highly constituted tissues. Irritability of the cicatrix may result from the circumstance of a nervous filament or trunk being implicated in it, as occasionally happens after an ordinary amputation; or it may occur without any such apparent cause.

The second order of consequences, comprising the *general* or constitutional effects, are those which more immediately endanger life. They may be arranged, chiefly according to the periods at which they occur, into six groups. First,—When a large extent of surface is burnt though but superficially, and more particularly when to the third degree, a shock is communicated to the nervous system, either by the intense pain excited in the wide expanse of integumentary nervous web which is injured, or by the sudden destruction of the functions of the integument. It is believed that this shock occasionally causes instantaneous death by asthenia, or the asthenic form of syncope—the heart ceasing to act, from its irritability or contractile power being annihilated. The same result may take place when the burn, though of less extent, has penetrated more deeply and injured some vital or important organ; but, with this exception, it is a well-ascertained fact that burns are more dangerous from their extent than from their depth. Second,—More frequently it happens that death is *not* immediate. There is great depression and collapse of the vital powers, which gradually sink in a few hours. The immediate cause of the fatal issue in this instance may be, as in the former, asthenic syncope, with this difference, that here the functions of the heart are slowly and gradually suspended, instead of being instantly arrested. Females, children, and persons of a nervous and irritable temperament, are most liable to sink in this manner. In other cases, death is preceded by typhoid symptoms, low muttering delirium, and coma. When the functions of a large portion of integument are suddenly suspended, the healthy balance between them and those of the lungs is destroyed; the latter become, with the other internal organs, greatly congested, and soon cease to effect proper aeration of the blood. This leads, to more retarded circulation in the pulmonary system; the brain is supplied with imperfectly purified blood; coma ensues, which still further retards the flow of blood through the lungs; and death results at last, from apnœa, accelerated by coma. Third,—In other cases, the collapse goes off, and is succeeded by an imperfect and feeble re-action, attended with great irritability and excitement of the nervous system, under which the patient may sink exhausted. Constitutional debility and irritability predispose to this termination. Occasionally, death has occurred about this period from tetanus, or from convulsions. Fourth,—On the disappearance of collapse, vigorous re-action may ensue. When this is confined within proper limits, it is the first step towards recovery; but when excessive, and accompanied by very high symptomatic or inflammatory fever, it is equally perilous to life, as would be its deficiency. Sometimes, accordingly, the patient dies during the stage of excessive re-action. At this period, also, congestion and inflammation are very apt to occur in the mucous membranes, and in several internal organs, more especially the lungs, the intestines, and the brain. These serious complications render the prognosis much more unfavourable, and frequently prove the chief causes of death. The upper portion of the duodenum is the part of the intestinal canal which is most frequently affected. Sometimes the inflammation here leads to ulceration, especially in young persons; and, occasionally, during the ulceration, a small artery is opened, hemorrhage ensues, and the patient generally dies, either from profuse loss of blood at one time, or from a more sparing discharge, frequently repeated. Death in this instance takes place by that form of syncope in which the heart primarily ceases to act, from the want of a sufficient volume of blood to excite its contractions; the nervous system being consecutively affected by the deficiency of the nutrient fluid. This mode of death is accordingly called, by Dr. Watson, anæmia. Of hemorrhage from the above cause a considerable number of cases are now recorded. In other instances, as has been so well pointed out by Mr. Curling, this ulceration of the duodenum speedily causes death by perforation. Gangrene, from excessive inflammatory re-action, may prove fatal by a combination of asthenic syncope and coma. Any of the serous membranes, or the organs which they invest, may, in like manner, be attacked by inflammation. As a general rule, those internal parts are most apt to suffer which are nearest to the external lesion. Apoplexy occasionally occurs from the fifth to the seventh day. Dupuytren considered this to be owing to idiosyncrasy; but it is more simply explained by referring it to vascular excitement, when the arteries of the brain are already in a state of disease. Confirmed drunkards have been attacked, about this period, with delirium tremens; and in pregnant females, the premature expulsion of the fœtus is said to have occurred. Fifth,—During, and after the detachment of sloughs, new dangers arise. In bad constitutions, or where the powers of life are much enfeebled, the separation of the eschar by ulcerative absorption may not have been preceded by a sufficient effusion of plastic lymph on the layer of living tissue next to the dead mass. Accordingly, if any considerable artery, or even vein, has been involved in the slough, dangerous or fatal hemorrhage may take place from its open mouth, which has not been sealed up, as under a more favourable state of the system it would have been. The same result may ensue from an artery being denuded at this period, and afterwards ulcerating. The possibility of such an occurrence suggests the propriety of using *no* force in removing the sloughs, lest the blood-vessels be not yet prepared for the separation. When the eschar has been very extensive, persons have occasionally died soon after its separation without any very obvious cause, unless it has been owing to the sudden exposure of a large ulcerating surface to the irritation of the atmosphere, inflicting a second shock on the system, which, though it was able to withstand the primary effect of the injury, succumbs to this second attack in its now enfeebled state. If this be the true explanation, then the raw surface, when of large extent, should be exposed only partially, and that as seldom and for as short a time as practicable, at each dressing. During suppuration, phlebitis and pyæmia have sometimes occurred, and destroyed life with the most urgent typhoid symptoms. After all the preceding dangers are past, if the process of cicatrization, over a large surface, be tedious, and suppuration very profuse, the exhausting effects of this drain on the system, combined with long confinement, tend to induce hectic fever, under which the patient may sink. The fatal issue is sometimes much accelerated by the development and rapid progress of phthisis pulmonalis. A more common adjunct of the hectic, is colliquative diarrhœa, from irritation and ulceration of the intestinal mucous membrane, particularly in the vicinity of Peyer's glands on the lower part of the ilium. Sixth,—Even the period of cicatrization, according to Dupuytren, is not exempt from danger; for he mentions that when this process has been nearly or entirely completed, persons have sometimes died suddenly, and in a manner unaccounted for even on dissection. This singular occurrence may be supposed to be connected with the suppression of the purulent discharge, which, though not natural, yet from its long continuance before cicatrization was effected, had become a habit—and, in fact, necessary, in some degree, to the constitution.

Post-mortem Appearances.—The local effects of burns have already been sufficiently described to enable any one to understand what conditions may be expected on an examination of the parts with the scalpel, when opportunity offers for so doing. In persons who have died immediately, or shortly after extensive burns, from the primary shock, Dupuytren says, the intestinal mucous membrane presents, in many places, bright-red patches of variable size, and other marks of great congestion,—the fluids of this canal, especially in the stomach, being deeply tinged with blood. The cerebral sinuses are gorged with blood; the brain and its membranes very much injected, its ventricles filled with a pinkish serum; and a similar fluid is found within the peritoneum, pleura, and pericardium,—these being in some parts dotted, or streaked with red points and lines of vascular injection. The discovery by Mr. Curling, in cases where death was delayed for a few days, of a sloughing ulcer of the duodenum, and its consequences, has been already noticed. When the patient dies during re-action, many of the above-mentioned appearances may be present. The symptoms during life will assist in pointing out which organ, if any, will be found the principal seat of inflammation or of congestion.

The *Prognosis* of burns, except of those which are very trifling, is always uncertain in the early stages; not only from the possibility of any of the preceding fatal terminations occurring, but also from the circumstance that it is frequently impossible, till an advanced period, to predicate the amount of lesion. In some instances, it is doubtful at first how far the destruction has extended; and in others, the immediate injury is followed by a secondary sloughing of the tissues, consequent on the violent inflammatory re-action in these parts, the vital powers of which were considerably lowered, though not entirely destroyed at the moment when the injury was inflicted. In forming a prognosis we must be influenced by a consideration of these points, and of the sex, age, constitution, previous habits, and present sanatory condition of the patient; as also of the extent of the burn in superficial area, and in depth;—of its relative situation, and the nature of the part. Females, children, and persons of a weak, nervous, and irritable temperament, are, as might be expected, more liable to the dangers attendant on this kind of injury than males, adults, and those of a stronger, and less excitable constitution. Old age again, which by its accompanying debility is exposed to the dangers of the former class, and is little able to survive the shock, or to support the tedious suppuration, is however less liable to those congestive and inflammatory attacks, which so often complicate the injury in younger and more full-blooded individuals. Previous pernicious habits, present disease, and any circumstance which tends to weaken the general health, increase the danger. Intemperance in alcoholic liquors is a strong predisponent to a fatal issue in this, as in other serious injuries. These various conditions do not all agree in producing danger in the same manner. Thus a weak and nervous individual, be the weakness from whatever cause, whether from the extremes of age, from disease, or from previous irregularities, is peculiarly liable to sink under the primary shock. To a strong plethoric adult the period of re-action, with its internal congestions, and it may be inflammations, is the most dangerous. Asthenic persons, again, if they have survived the preceding stages, are, especially when of the strumous diathesis, prone to succumb during the period of suppuration and hectic. It was before stated that the danger of a burn is proportioned more to its extent of surface than to its depth, except when in the latter case vital or important organs have suffered. The depth, on the other hand, more than the superficial area, regulates the amount and nature of the local sequelæ. The influence of relative situation is shown by the circumstances of a burn, producing in one site very serious consequences, while in another it may be comparatively unimportant.

With regard to the local results, it may be considered a general rule that, other things being equal, a burn will produce an amount of deformity directly proportional to the freedom of action naturally enjoyed by the part which is the seat of injury. Thus, when in the neighbourhood of a joint, its fixation—when near the mouth, hideous distortion—close to the eyelids, their eversion, ectropium, adhesion of their margins to one another—are conditions easily induced. The influence of relative situation in causing danger, is exhibited by otherwise insignificant burns of the scalp, exciting inflammation in the brain or its membranes; of the thorax and abdomen, in inducing the same morbid action in the serous linings of these cavities; and in the latter situation, when deep, predisposing to hernia or protrusion of some of the viscera, from weakening of the abdominal parietes.

Again, when situated near the orifices of mucous canals, the transit through them may be materially interfered with, whilst their natural secretions, coming in contact with the sore, may deteriorate its action, and retard its healing. Thus in a scald of the mouth, fauces, and pharynx, from an attempt to swallow a boiling fluid, dysphagia or difficulty of deglutition will ensue, which, if the injury be severe, may not pass off with the inflammation, but may continue permanently, through contraction or stricture of the upper part of the œsophagus. But there is here a more immediate source of danger: the scalding liquid may penetrate into the larynx as far as the glottis, and excite acute inflammation of it and of the epiglottis; or the same result may take place by propagation of the action from the pharynx, without the fluid passing below the epiglottis into the larynx at all. This condition will produce dyspnœa, or even death by apnœa if not relieved. In these instances, it is believed that the liquid does not pass down into the œsophagus, or farther down the larynx than the rima glottidis; the spasmodic muscular action, in both these parts, effecting closure of their respective canals. Occlusion of the puncta lachrymalia may ensue from a burn in their neighbourhood. Dysuria results when the genitals are implicated; and, in the female, the contact of the acrid urine may aggravate the injury. When close to the anus the pain experienced during defecation induces the patient to perform this as seldom as possible, and constipation is the natural sequence. The situations, then, on which burns are most dangerous, are the head and neck; the genitals, particularly in children; and the trunk generally. When on the hands and feet, tetanus has followed, as well as in the case of other injuries of the same parts.

It has been stated, that a fatal result almost certainly takes place from a burn of the first or second degree, which involves half of the entire surface of the body; from one of the third, affecting a quarter; and from those of the fourth, fifth, and sixth, in which the eschar comprehends more than a square foot. No doubt, these points may frequently be found to be correct; but from what has been said above, it will be evident that under particular, though by no means unusual, circumstances, a much smaller amount of injury may lead to death.

The *First Degree* is most commonly caused by contact with heated liquids or vapours, or by radiation. The four common symptoms of inflammation are present,—namely, redness, heat, pain, and swelling; while the absence of vesication distinguishes this from the next degree. The redness is of a bright rosy hue, diffused—not circumscribed, disappearing momentarily under pressure, and very similar to that of erythema, of which this may be considered a traumatic form. The pain is acute, of a smarting or burning character, and it generally lasts as long as the redness remains. The swelling is but slight, except when on mucous membranes. These symptoms disappear by resolution in a few hours, or at most, in two or three days. In more severe cases, a slight desquamation of the cuticle ensues in the form of light furfuraceous scales. A degree of tenderness in the part frequently remains for a few days longer.

When the shock has been very great, collapse is present; marked by a weak, fluttering, and irregular action of the heart, and a pulse almost imperceptible at the wrist. The person is scarcely conscious, his sensations are impaired, and his gaze is vacant. When re-action is established, symptoms of any of the complications already enumerated may exhibit themselves.

Local Treatment of the First Degree.—In burns of the first degree, the objects of *local* treatment are, to mitigate pain and prevent effusion. When an extensive surface is affected, the whole should not simultaneously be exposed to the atmosphere; and any necessary exposure should be as brief as possible. In slight burns, local treatment may alone be requisite, consisting in the steady application of cold for several hours, either by simple immersion or wet cloths. Immersion is of course only applicable when the surface involved is small and suitably situated, and when no collapse is present. The water employed must be kept cold by frequent renewal. When the part is not conveniently situated for immersion, it should be closely, but at the same time lightly, enveloped with a single layer of soft linen or cotton kept constantly wet with some cold liquid. Simple water may be employed, with the addition, if thought necessary, of a little alcohol, to increase the evaporation and the consequent cold. Dupuytren used an acetate of lead lotion, which he considered sedative and astringent:—it is a very excellent application. After the incipient inflammation has been thus checked in the onset, the part, if of any extent, must be defended alike from the stimulus of the atmosphere and the depressing influence of cold; one or both of which might injure it in its present delicate condition. This may be variously accomplished, either by rolling fine carded cotton or wadding around the part; or by varnishing the surface with a thin layer of some bland adhesive substance, which will, for a time, perform the part of an insensible cuticle. For this purpose, mucilage of gum arabic, or tragacanth, or the ethereal solution of gun-cotton known by the name of Collodion, may be employed. The Collodion, and probably the mucilage also, seem to act in two ways;—first, by protecting the surface from contact with the atmosphere; and secondly, by contracting to a certain extent as it dries, which, together with its close adhesion to the cuticle, tends to keep up a degree of pressure or compression, that proves beneficial to the weakened part, as well by affording it support, as by favouring the absorption of any slight interstitial effusion. The varnish may be removed, when the vascular action in the subjacent integument has quite subsided to its natural standard. If applied, however, over a large surface, it might prove injurious by mechanically obstructing the cutaneous transpiration of the part; and this would favour the occurrence of vesication. Such an objection does not apply to cotton. For a like reason, the aqueous mucilages are less objectionable on the large scale than collodion, which is quite impervious to moisture; while they readily imbibe a little from the surface below, which not only relieves the subjacent integument, but also prevents undue desiccation of the protective layer, and its consequent cracking and peeling off.

But where a very large surface is burnt, and when the depression is considerable, the continuous application of cold cannot be had recourse to, as it would tend still farther to lower the system. In this case, a warm opiate fomentation may be employed, which will greatly mitigate the pain; and subsequently, the cotton or varnish may be employed as before. Some persons employ the cotton in the first instance; and this will be the most judicious treatment in many burns of the first and second degrees, where, from the great extent of injured surface, neither cold nor warm lotions can be conveniently employed. The cotton, moreover, has this obvious advantage, that when once applied in such cases, it needs not soon to be disturbed; while liquid appliances, on the contrary, require frequent or constant attention and renewal. This peculiarity forms a decided recommendation of it for those distressing cases of great severity, in which all hope of life is at once destroyed; and in which, therefore, the treatment ought from the first to be chiefly directed to soothe the suffering of the last moments. A popular application, which deserves mention as a ready substitute for the cotton or varnish, after the vascular action has been repressed, is flour, dusted thickly over the reddened surface. It is applicable to burns of the first degree; but not when the injury has caused, or is likely to cause vesicles; for, by the bursting of these, the flour becomes a mass, which on hardening, irritates the skin, instead of protecting it.

Stimulant applications from the commencement have been recommended; but, in the early stages of all burns, they tend to increase the vascular action, and so carry the injury to a higher degree than it would otherwise have attained. Turpentine has been considered to exercise a constringing action on the vessels of the integument, and thus to prevent effusion; but this substance on many skins, even when in the healthy condition, is itself a very powerful rubefacient. In slight burns of the face, from explosions, by which the eye is injured by particles of gunpowder stuck on, or into, the conjunctiva, all the large grains should be removed at once; after which, linen cloth, kept very wet with cold water, or a cold, light, very moist bread-and-water poultice enclosed in a cloth, forms the best application, and is to be laid across the eyes, the patient lying in bed. The water here dissolves and carries off the nitre of the powder, while its remaining constituents, sulphur and charcoal, are washed away. Those particles which remain should after a day or two be carefully picked out with some fine-pointed instrument. The operation, which has been advised, of picking out with the point of a needle all particles of gunpowder that have lodged in the skin, would be, in many instances, where the whole face and head are thus tattooed, as impossible to execute, as it would be dangerous and cruel to attempt.

The treatment of pharyngitis, or laryngitis, following an attempt to swallow boiling water, does not differ materially from that proper for acute idiopathic cases of the same nature;—it must be instant and energetic. It consists chiefly of depletion, local or general according to circumstances, counter-irritation, the exhibition of antimonial or mercurial medicine, and the employment of a tepid demulcent gargle. Bronchotomy, as a last resource, should be performed as early as the necessity for it is evident, because the ultimate success of this operation, as of that for strangulated hernia, depends very much on the period at which it is instituted.

The *Second Degree* of burn is characterized by the presence of vesication, in addition to the erythematous rubefaction observed in the first. The vesicles form where the heat has been most intense, or longest applied. Though generally formed immediately, or very soon after the occurrence of the burn, they may continue enlarging, or new ones may be formed during the next twelve or eighteen hours, if the part has not been properly protected from irritation. The contained serum may be either clear or opaque, colourless or tinged with various shades of yellow and red. Around them for some distance, the first degree of burn prevails, but the swelling and pain are here greater; the latter, when the phlyctenæ are large and full, being accompanied with a feeling of tension. Such is the state of matters when, as is most commonly the case, a hot liquid has produced the injury; but, when it is occasioned by actual contact with a heated solid, the epidermis frequently adheres to it, and is torn off along with it on its removal. When this happens, the pain experienced, from exposure of the denuded surface to the atmosphere, is exceedingly acute, and slight suppuration is almost inevitable. This suggests the propriety of not lacerating the vesicles; or if, to relieve their tension, it be necessary to evacuate part of their contents, of making the opening as small as possible, and then preserving the cuticle otherwise entire until the surface beneath shall have no need of such protective covering. Under favourable circumstances, the detached cuticle dries, and shrivels up in a few days; it then falls off, or may be removed, its place being supplied by a new layer of similar structure, as yet, indeed, more delicate, and of a reddish hue, but which soon assimilates its appearance to that of the original tissue. Even if slight suppuration occur, no mark is, after a time, discernible; but if the purulent secretion be from any cause protracted, a scar or slight disfigurement ensues, which, however, with time and appropriate treatment, ultimately disappears.

The *Local Treatment of the Second Degree* of burn differs from that of the first, in so far only as the appliances to the vesications are concerned. When produced, as this grade usually is, by scalding fluids, some parts covered by the clothes are generally more or less injured; and in the removal of these the greatest possible care is requisite to prevent laceration of the vesicles, or the tearing away of the detached cuticle. If the vesication be slight, the treatment for the first degree may be instituted, taking every care that the elevated epidermis be preserved from injury. But if the subcuticular effusion be very great, the vesicles, as they become large and tense, should be punctured with a small needle. The evacuation of their contents in this way affords much relief; and if the fluid reaccumulate, it may again be discharged in a similar manner. Cold astringent lotions offer the most probable means of limiting the effusion; but these may be counter-indicated by various circumstances, which have already been sufficiently explained while speaking of the treatment of the first degree. Glycerine, mingled with an equal quantity of water, has lately been recommended as a topical application in burns of the first and second grades. It certainly has the property of keeping the part soft and moist for a long time. If the cuticle has been torn off, the raw surface, when large, is most effectually soothed and protected by the Linimentum Aquæ Calcis; or when small, by forming an artificial crust over it with mucilage, collodion, or the nitrate of silver, which being applied gently to the moist surface, coagulates the secretions, and thus forms a protective layer. Over the thin crust produced by the lunar caustic, a piece of goldbeater's skin should be applied, to prevent its cracking and premature detachment. The method of healing by incrustation is preferable, when the prevention of scars is an important object, as it is when the face, neck, arm, or hand, especially in a female, is the seat of injury.

The Linimentum Aquæ Calcis, or Carron Oil, as it is popularly termed, has been sometimes employed indiscriminately over the whole of the burnt surface, whether blistered and denuded or not; but its employment in this manner is attended, in some degree, with the same objection formerly offered, that of preventing the application, over a large area, of a varnish impermeable to aqueous moisture, owing to its checking or preventing the cutaneous transpiration,—an effect which is, with justice, believed to increase the subcuticular effusion. The common turpentine liniment, composed of turpentine and resinous ointment, is objectionable on the same account, and is, besides, much too stimulant an application to the blistered surface. If the effusion in the vesicles become decidedly puriform, the raised cuticle must be freely incised, and the surface treated as an ordinary ulcer, should it continue to suppurate; or the incrusting process may be tried, if the secretion of matter be scanty.

The *Third Degree* of burn consists of cauterization of the epidermis, and the papillary or superficial layer of the dermis. Gunpowder explosions are said frequently to produce this grade; and the skin, in these cases, is permanently tattooed, in many places, by the lodgment of black particles driven into it. In this grade, the part is usually charred at once, or it dies very soon. The eschars, in the slighter cases, are so thin as to resemble mere stains; but in other instances, they may be half a line or more in thickness. They vary in colour, from greyish-yellow to dark-brown; and, in consistence, from a moist and soft, to a dry and hard though pliant condition. When produced by a scald, they are usually of the lighter hue, and softer consistence; and as, under these circumstances, the vitality of the part has not been instantaneously destroyed, the slough is frequently covered with dark vesications, the fluid contained in which is sanguineous, and of a red or brown colour. These are seldom found over an eschar which has been produced immediately by a solid of high temperature, because the slough thus formed is usually dry and hard. It is in that case also depressed, while the surrounding integument is corrugated and drawn in around it. When present, however, Dupuytren regarded these dark-coloured vesications as extremely characteristic, indeed diagnostic, of this degree of burn. When produced by a solid body which has remained for some time in contact with the skin, or by a metal in the state of fusion, the cuticle, together with a thin layer beneath it, is occasionally torn off at the time, leaving the dermis exposed, and of a greyish colour, part of which dies subsequently, so that nearly its whole thickness is destroyed. Immediately around the charred portions of integument, the skin will be found to have suffered to the second degree, as exhibited by the limpid vesicles; and still further off, to be merely affected with the erythema of the first. Dupuytren remarked that, while in every burn the pain is acute, it is much more intense when the skin is burnt only on its surface, than when the injury extends more deeply. Accordingly, the third degree of burn is found to be the most painful of any; though some writers have stated it to be less so than the two preceding varieties. The danger to the constitution, also, is proportionately greater here than in these,—primarily, because the shock is greater and the pain more intense; and secondarily, because the reparative powers of the system will be more largely taxed in this than in the more superficial injuries. So soon as the parts are quite dead, there is a remission of the pain for a few hours, until inflammation be established, and the process of separation commenced; yet even during this interval, though the eschar itself be insensible to the touch, yet, from its thinness, a very gentle pressure on it, by being transmitted to the living and sensitive structure beneath, will excite acute pain. Upon the supervention of inflammation, there is a re-accession of pain, and it now continues very severe, until a short time after the sloughs have been thrown off; the period of which occurrence varies according to their thickness and the vigour of constitution, from four to fourteen days after the infliction of the injury. The removal of the sloughs must not be hastened by force, on account of the pain which such treatment would occasion. The remaining sore is superficial, and generally cicatrizes rapidly. The resulting cicatrix is at first redder than the surrounding integument; but subsequently it becomes preternaturally white; its surface depressed, smooth, and imperfectly papillated; or sometimes, when suppuration has been prolonged, it is marked by irregular lines, ridges, and corrugated knots. The local result is, therefore, disfigurement.

The *Local Treatment of the Third Degree* of burn will be described along with that proper for the fourth, as the same case usually presents the characters of each. It will be sufficient, at present, merely to mention the formation of an artificial crust, by some of the methods already described, as being very applicable when the eschar is thin, and most desirable when it is on exposed parts, as the cicatrix, obtained in this way, is much more perfect and similar to the original integument than that resulting from ordinary granulation.

The *Fourth Degree* of burn is generally produced by the actual contact of a solid body at a high temperature. In this case an eschar is at once formed, comprehending the whole thickness of the skin, and frequently, also, the subcutaneous cellular tissue. It is here dark, brown, or black in colour; dry, hard, and leathery, yet brittle, in consistence; and is quite insensible, pressure producing little or no pain, even in structures naturally the most sensitive,—the dermis being completely destroyed. Owing to the fluids having been thus almost instantaneously expelled from the carbonized integument, diminution of its bulk necessarily ensues, both in its thickness and its superficies. The eschar is consequently depressed below the level of the surrounding skin; and the latter, still more than in the third degree, is drawn in around it, exhibiting numerous puckered folds or corrugations radiating from the margin of disorganization. When the part dies more slowly from the violence of inflammatory re-action, the slough is softer and less depressed. Its thickness varies from one to three lines, being, for the same depth of destruction, thinner in the hard and dry variety, because of its greater density and compactness, than in the soft and moist form, which is more loose and flabby in its texture. Receding from the point where the heat has been most intense, the three minor grades of burn are generally observable; that of the most superficial character occupying the most distant site. The pain is severe so long as the application of the cauterizing agent is continued; but upon its removal it ceases, at least in that spot, for a few hours, during which time, little more than uneasiness may be felt in the part which bears the characters of this degree, because the structure which would have been most acutely sentient, had its vitality been preserved, has been at once destroyed. If, however, the neighbouring surface be affected in a more superficial manner, then the pain, already described as attendant on burns of the first three degrees, will be experienced. Even if the latter condition should not exist from the first, it will ensue, in the course of a few hours, and severe pain will then become developed from inflammation attacking the integument around.

In three or four days, the parts beneath the slough have, from the same cause, become painful; and both cause and symptom increase in severity during the first week, at the expiration of which period, or about the ninth day, their intensity begins to decline, and afterwards suffers a gradual diminution, which is contemporaneous with the establishment of the process of separation between the dead and living structures. The process of ulcerative absorption by which this is effected, having been described in another part of this work, need not be related here. The separation is effected during the third week after the infliction of the injury. Granulation now proceeds, in some cases, with sufficient activity; but very often it assumes the indolent character, and is attended with profuse suppuration, when the surface is of large extent. The cicatrix, when at last completed, is, as before explained, much smaller than the original destruction of integument; it is permanently depressed, of a fibrous appearance, smooth unless cicatrization has been irregular; possessed of little common sensibility, and very liable to chafe and ulcerate. Thus by its appearance it constitutes, at least, a disfigurement; while by its contraction, or adhesion to parts beneath, serious deformities may be produced, attended probably with much loss of motion.

Previous to separation of the slough, or, at least until that condition be considerably advanced, it is often difficult, if not impossible, to pronounce with certainty whether a burn be of the third, fourth, or even of the fifth degree, especially in situations where the bones are but thinly covered by soft parts; because the secondary sloughing consequent on the inflammation which attains its height about the ninth day, is frequently so extensive and profound, as to make an eschar, which at first seemed inconsiderable, become subsequently of very formidable dimensions. A knowledge of the manner in which the injury was produced as regards the nature of the agent, and the mode and duration of its application, will assist in forming an idea as to how far the caloric may have penetrated.

The following remarks will usually be sufficient for ascertaining the *primary* amount of destruction. The present degree is distinguished from the third, by observing that in this, severe pressure on the eschar at an early period produces little pain; while in the more superficial lesion, gentle pressure produces intense agony. As before explained, there may be here also very acute pain from the commencement, owing to a superficial inflammation of the surrounding skin, and until pressure be actually made on the primary slough, the patient's sensations may not be so well defined as to inform him that under *it* at least, there is little or no pain. From a burn of the fifth grade, the present degree is distinguished by its comparative want of resonance on percussing the eschar, which property, if present at all, can, from the thinness of the slough, exist only in a very slight degree; while in a burn of the fifth grade, a distinctly sonorous effect is produced from the eschar. Of course, in any case, where the slough is of the soft and moist description, percussion is useless, and could produce no distinctive sound.

The *Local Treatment of the Third and Fourth Degrees* of burn comprises four indications; namely—to regulate the amount of inflammation; to favour separation of the sloughs; to assist the processes of granulation and cicatrization; and to prevent, or, in some cases, to modify deformity. The first indication, which is to regulate the amount of inflammation, requires that its activity should be repressed when excessive; and that when defective, local reaction should be promoted, because a certain amount of vascular action is necessary to effect the detachment of the eschar, and the subsequent cicatrization of the sore. To limit the inflammation, an elevated and relaxed condition of the part should be preserved. If it prove excessive, so as to threaten extensive secondary sloughing, local depletion may be required; in estimating the necessity for which, the character and degree of the general symptoms of pyrexia will render valuable guidance. In robust and plethoric adults, in whom, when the injury is of small extent, the system has been little depressed, the early abstraction of blood by leeches may limit very considerably the impending destruction of tissue. These should be applied, when the collapse has quite worn off, as near as possible to the threatened part. Perhaps in a few rare cases moderate general bleeding may be advisable, in order to restrain the local action; but either form of depletion must be employed with the *utmost* caution, and in as sparing a manner as will suffice for the attainment of the immediate object in view; more especially when the amount of destruction has been great, because, as will afterwards be mentioned when describing the constitutional treatment, it will be injudicious to weaken the powers of the system, when it will soon have need of all its energies to carry on the work of reparation.

On the other hand, when local and general reaction prove very tardy and defective, stimulant applications must be resorted to, in order, first—to excite a sufficient amount of local inflammation to throw off the slough; and, secondly—through this medium to assist in rousing the system from collapse. For this purpose, the liniment composed of resinous ointment and turpentine may be applied, and its stimulant properties regulated by varying, when necessary, the quantity of the latter ingredient.

The manner of fulfilling the second indication, which is to promote separation of the slough, may vary a little under different circumstances. The warm water dressing, consisting of cloths dipped in warm water, and covered with oiled silk to prevent evaporation and cooling, is usually the best appliance; and if there be much pain, the water may be medicated with opium. Light poultices answer the same purpose; but if large, they prove, from their weight, especially when on the trunk, distressing to the patient. If the inflammatory action be very weak, the applications may be rendered stimulant by the addition of a metallic salt. No mechanical force must be employed to detach the eschars; but if a large piece be loose except at one point, the greater portion of it may be cut off near the point where it is still attached. Occasionally matter forms under a part of the eschar, and, accumulating, gives rise to pain and tension. Fluctuation is perceptible at the part, and free incision of the slough is requisite to permit the escape of the purulent collection.

The third indication, which is to promote granulation and cicatrization, comes into play immediately subsequent to the separation of the eschar; when the usual treatment of granulating sores, as described while treating of the results of inflammation, is to be instituted. If there be much fœtor, a weak solution of the chloride of zinc, or of soda, may be advantageously employed. If the sore lose its vigorous character, and become indolent, the part, especially when on an extremity, should be encircled with a lightly-applied bandage, which not only affords support, but, by the gentle pressure which it exerts, tends to prevent that flabby exuberance of granulation which is so liable to occur, and so certain, if it do occur, to retard cicatrization.

It is proper here to mention that these injuries have been, and are sometimes at the present day, treated differently, by means of unctuous applications, of cotton, &c. The former of these are, however, by no means so cleanly as the water-dressing. The Unguentum Calaminæ, and Oleum Palmæ, are probably the least objectionable of them; and it is advised to spread them thinly on lint, in which a number of small apertures have been made, so as to permit the free escape of matter from beneath the immediate dressing. The surface is also dusted over with vegetable charcoal by some surgeons, with the intention of thereby sopping up the profuse discharge. This is certainly not a seemly application; and its use, when possible, had better be avoided, as the washing, required at each dressing to remove this substance, cannot be beneficial to the tender granulating surface. With regard to cotton, the application of which has been recommended in numerous layers, Professor Miller justly remarks, that in these severe burns, it "would speedily become soaked with the discharge, and either require frequent renewal or else prove a very hotbed of pestilential putrescence."

The fourth indication, which is to prevent, or, in some cases, to modify deformity arising from the centripetal tendency of the structures around the burn, during and after cicatrization, is accomplished chiefly by preserving the parts in such an attitude that the tissues must be approximated longitudinally as regards the long axis of the body, rather than in the transverse direction. For it will be observed that contraction of the cicatrix in the former direction will rarely produce deformity, though it may cause a degree of tension and stiffness; while in the latter, serious impairment of motive function may readily be induced, from fixation of a joint even in a convenient attitude, or, what is more common, in an extremely awkward and sometimes an absolutely dislocated position. In order to obviate this, the position of the part during the progress of cicatrization, and for some time after its completion, must be so ordered that it will oppose any such malposition of the joint implicated. The period of complete cicatrization may be thus somewhat deferred; and if, during this delay, hectic should supervene, or prove more urgent, all opposition to nature's own manner of cure must be desisted from, and subsequent measures trusted to, for the palliation or removal of any deformity which may have accrued from it. The contraction can be moderated, and its direction regulated, in many situations, where bandages would have no effect, as on the face, neck, and some parts of the limbs, by strips of isinglass plaster. As there is at the angles of commissure of the fingers and toes a great tendency to union of the opposed surfaces, the dressing must be carefully inserted between them up to the top of the fissure, and a turn of a bandage brought above, so as to exert a steady pressure on the part. Natural orifices must be kept, by appropriate mechanical means, from closure or constriction, during cicatrization in their neighbourhood. To prevent fixation of a joint, either from contraction of the tissues, or from its long continuance in one attitude, passive motion must, in the latter stages, be cautiously instituted, and the exact position of the articulation varied a little from day to day. But in many cases the destruction is so deep, or so extensive, that partial or complete loss of motion must inevitably ensue. In these instances, the joint, during treatment, must be preserved in that condition, as to flexion and extension, which will render the limb most useful if spurious anchylosis occur. This position, in the elbow, will be semiflexion, the fore-arm being bent nearly to a right angle with the arm, and, in the knee, almost complete extension.

Amputation can seldom, if ever, be requisite in burns of the fourth degree, except in rare cases of very profuse and obstinate discharge from an extensive surface, in which the hectic proves imminent; or when the soft structures over the bone are exceedingly thin, and are destroyed all around it, which occasionally happens in the fingers and toes, a burn of the fourth class in these situations being *locally* as severe as one of the fifth degree in better protected parts.

The *Fifth Degree* of burn consists of a disorganization—not only of the skin, but also of the subjacent soft parts to a variable depth, occasionally down to the bone itself. In this case the primary eschar when produced instantaneously, or at least rapidly, by incandescent or burning bodies, is black, depressed, and dry; hard and sonorous on percussion. When the part dies more slowly, in consequence of the heat having been less intense, or applied for a shorter time, the slough is softer and more moist. It is quite insensible to pretty severe pressure, until inflammation has set in, around and beneath it, when of course pain accompanies the vascular action, and is aggravated by pressure. During the violence of this reactional process, secondary sloughing of the tissues is very apt to occur. Arteries and nerves sometimes preserve their vitality in midst of the disorganization, for several days. More commonly, however, they perish at the same time with other tissues; and if they happen to be large or important trunks, gangrene of the distal parts supplied by them may possibly be the result. The minor degrees of burn will usually be observed in more or less regular gradation, receding from the point where the heat has been most intense; but independently of this source, pain becomes developed in a few hours after receipt of the injury, from inflammation arising in the superficial parts immediately around the eschar; and owing to the same circumstance, during the second week, pain on pressure is elicited, gradually extending from the circumference to the centre of the slough, as the vascular action increases beneath it. At the expiration of that period it begins partially to separate; the most highly organized structures being the first thrown off. In persons of bad constitution there is at this time danger of hemorrhage from arteries which have suffered solution of continuity, and which, owing to the vitiated state of the system, have not been occluded previous to the exposure of their extremities. Pieces of tendon remain frequently for several weeks undetached, if not cut away; and if bone have become necrosed, the exfoliated portions may not be thrown off for a much longer period. After an extensive injury of this severe character, the system requires some time to rally; and it is not, in general, until two or three days after its occurrence that reaction is fully established. During, and for a considerable time after, the separation of the slough, the suppuration is very fœtid and abundant. Owing to the depth of the sore, healing advances very slowly. Muscles, tendons, and aponeuroses become adherent to each other, and contribute to form the cicatrix, which, when at last completed, is uneven and irregular, and effectually prevents any motion of the parts which have assisted in its production. The local results of this degree of burn may be any of the different varieties of deformity or mutilation, attended by corresponding impairment or loss of function.

The *Local Treatment of the Fifth Degree* of burn is precisely similar to that already indicated as proper for like injuries of the fourth. Amputation is requisite in burns of this degree under the following circumstances:—First, when upon separation of the slough, the interior of a large articulation, such as the knee or ankle, is laid open. Secondly, when the same result follows inflammation and abscess in its interior. Thirdly, when a large portion of bone is exposed on the detachment of the eschar, a condition which would induce extensive necrosis. Fourthly, when the loss otherwise is so great as to hold out little expectation of the sore healing; or, if that should take place, of the limb, thus preserved, proving anything but an incumbrance to its possessor. Fifthly, at a later period, amputation may be called for to save the system from sinking beneath the hectic consequent on profuse and prolonged suppuration.

The *Sixth Degree* of burn, which consists in the complete charring of the whole thickness of a part or limb, is easily recognised by the part thus incinerated being shrunken, hard, totally insensible to the severest pressure, brittle and distinctly sonorous on percussion. This primary eschar is black in colour; and, when produced at once by the limb being enveloped by metal in a state of fusion, the line of destruction proceeds from the surface almost directly down to the bone; but when the carbonization has been more slowly effected, the eschar proceeds more obliquely through the tissues, gradually penetrating more deeply as it approaches the point of actual contact with the burning body, at which part everything, including the bone itself, is involved in destruction. The secondary sloughing, however, brings both cases nearly to the same condition in this respect, and when the eschar is thrown off, an irregular and conical stump remains, of which the bone forms the most projecting part, destined, ere cicatrization be effected, to die and exfoliate. The inflammatory reaction and separation of the slough go on here in a similar manner; but the latter requires a longer period for its accomplishment than in burns of the fifth degree. Mutilation, the most severe of the local results, is the inevitable consequence of this grade.

The *Local Treatment of the Sixth Degree* of burn consists usually of amputation. As the detachment of so thick an eschar is necessarily a work of considerable time, and as the stump then left is a very undesirable one, it is proper, unless counter-indicated by the existence of some unusual circumstance, to amputate in every burn of this grade. This is to be done so soon as the collapse has gone off, and before the supervention of the inflammatory, or, it may be, of the irritative fever, which otherwise would occur.

The *Constitutional Treatment of Burns* comprises *five* indications; namely—to promote reaction; to control and regulate its intensity; to watch for and treat inflammatory affections of the internal organs; to support the system under hectic and its complications; and lastly, to remove mechanically, under certain circumstances, the cause of the hectic.

The *first* indication, then, of general treatment is to promote reaction. It is said that reaction is mainly brought about by the severity of the pain; but this must be only when the pain is under a certain degree of intensity, for it is well known that this symptom, when excessively severe, itself exercises a powerfully depressing influence on the heart's action. In many cases, nature is able herself to rouse the system; but if not, reaction is to be promoted, when the patient can swallow, by the administration of some of the diffusible or more permanent stimuli, such as ammonia and brandy, in small and frequently repeated doses. When the general surface and the extremities are cold, warmth should be applied, and, if practicable, sinapisms to the feet and pit of the stomach; but the effect of these must be closely watched, lest they induce sloughing. Opium has been recommended in large doses to diminish the pain, but this will tend to increase still farther the cerebral congestion, which dissection has proved to be so common at this stage; while, on the other hand, small doses will have no effect. The pain should in these cases be relieved, as far as possible, chiefly by topical remedies. When the collapse remains long, a warm and slightly stimulant enema may be administered, and repeated if necessary.

This stimulant treatment, during collapse, must not, however, be carried too far; but is to be suspended as soon as signs of approaching reaction appear; for otherwise, when that stage is fairly established, the persistent effects of a superabundant stimulation, or, in other words, its surplus, would exaggerate the reaction, which would now require as active treatment in the opposite direction; and when subdued, if indeed it did not prove fatal, the system would be much more enfeebled than it would necessarily have been, had nature been left a little more to her own resources during her efforts to institute reaction.

When, as stated before, premature and asthenic reaction comes on, marked by great irritability and nervous excitement, with a rapid, throbbing, but feeble pulse, the exhibition of opium, in large doses, is attended with the most beneficial results.

The *second* indication is to regulate the intensity of the reaction. When it proves excessive, without apparently any internal organ in particular being attacked, the antiphlogistic regimen will in general be sufficient. In very few burns is blood-letting in any form required, or, indeed, in hospital practice, admissible; but it may possibly be demanded, in a few cases, to relieve the general inflammatory state of the system; and, at the same time, to moderate the local action, and thus limit the amount of secondary sloughing. In having recourse to these depletive measures, however, it must never be forgotten that, in all burns, except those of the first and second degrees, the powers of the system may at no distant day be taxed to their utmost to support suppuration, perhaps large in quantity, prolonged in duration, and secreted by an extensive surface. Accordingly, the slightest unnecessary lowering of the system will entail a still more profuse and protracted suppuration,—a still more tedious and possibly imperfect cicatrization.

The *third* indication relates to the inflammatory affections of various organs which may occur. Their onset is often very insidious, and so must be watched for. They are to be treated in accordance with the ordinary medical principles applicable to each particular complication. Blood-letting, when necessary, should be as moderate as possible, for the reason already specified; and also on account of the well-established principle, that depletion cannot be borne to the same extent in secondary inflammations after a shock or injury, as in a primary or idiopathic affection of the same nature.

The *fourth* indication is to support the system against hectic, and its complications. The appropriate treatment has been described when speaking of Hectic Fever. Over-stimulation must be guarded against, as this, equally with debility, impedes cicatrization, by inducing flabby and exuberant granulation. The bed-sores, resulting from long-continued pressure on the salient points of the back, sacrum, nates, and heels, exercise a very depressing effect. When threatened, a strong spirit-lotion is an excellent application; or, if already formed, the part may be pencilled with nitrate of silver. Under the crust thus produced, the part, if relieved from further pressure, will readily heal. Arnott's water-bed, or a Mackintosh air-cushion, affords great relief by equalizing the pressure over the whole decumbent surface.

The *fifth* indication is to remove mechanically, when necessary, the cause of the hectic. Amputation, though frequently performed to fulfil a merely local indication, namely, the removal of an useless limb, is sometimes necessary for the sake of the constitution. Thus, if hectic be extremely urgent, and the suppuration continue very profuse, with a large surface still remaining for cicatrization, while the amount of the former is not satisfactorily diminished, nor the rapidity of the latter materially increased by remedies, then amputation must be performed in order to save life.

Suppuration may be prolonged, and cicatrization delayed—from debility of system—from an extensive surface being involved—from bone having become necrosed—and from the opening of a large articulation, either by the sloughing of the tissues, or subsequent to inflammation and abscess in its interior.

Affections of the cicatrix.—This structure is very liable to excessive contraction, to chafing, fissure, ulceration, and irritability. With regard to the first of these conditions, Professor Syme remarks that the cicatrix, when recent and still soft, may be gradually stretched. In an instance on the upper extremity, the successful extension was conveniently effected by a strong iron-wire splint, which can be made in a few minutes, of any form, and when covered with soft washed leather is extremely useful. This splint admits of being straightened a little daily, while it has sufficient rigidity to overcome the resistance of the cicatrix. When, however, the latter has become hard and unyielding, it cannot thus be stretched; and attempts to do so have led to great pain, inflammation, and even gangrene of the lately-formed structure. Sometimes a few incisions, made through it, transversely to the desired line of extension, may relieve the contraction; but, in many cases, nothing but a plastic operation will succeed. This consists in making an incision in the cicatrix, so arranged as to permit the limb to be placed in an extended and unconstrained position, in which it is to be maintained: a flap of integument, corresponding in form with the surface exposed by the separated edges of the incision, is then dissected from some convenient part in the neighbourhood; preserving, however, at one part its connexion undestroyed, by which it is to be nourished until fairly attached in the new situation to which it is now transferred, retention till that time being effected by sutures and plaster. The wound occasioned by its removal is treated on common principles, and the connecting slip divided, if necessary, so soon as perfect adhesion has occurred. Another operation, which has been practised with success, consists in making two incisions in the form of the letter V, in the line of required extension, embracing the scar and meeting at a point on the sound integument below. The flap, consisting of the cicatrix with a narrow border of sound integument, is dissected from its apex towards the base, till the limb can be extended, and is then laid down on its now somewhat altered situation; the edges of the whole wound being brought together laterally. They are secured in the usual mode, and the lines of incision are now found to resemble the capital letter Y.

As the cicatrix, like all newly-formed structures, is very susceptible of absorption, the hard prominences, occasionally presented by it, can usually be removed by the steady pressure of some smooth and unyielding substance lightly applied; but if this fail, they may be cut out. The chafing, cracking, and ulceration to which the scar is liable are frequently very distressing. Slight injuries suffice to abrade its surface; it frequently cracks when much over-stretched during motion of the part; and ulceration may follow either of these conditions. To guard against these states, all of which may likewise be induced or aggravated by cold, the cicatrix should if possible be kept well defended from external influences by a warm, soft, and fleecy covering, and by strict attention to cleanliness. But the same conditions sometimes arise spontaneously, as it were, or from some constitutional cause, which, if discovered, is to be rectified. When the fissures proceed from cold or other external irritation, glycerine, if it prove equally serviceable here, as in common cases of "chopped hands," will speedily effect a cure.

The cicatrix, though little sensible to touch, is often morbidly sensitive to atmospheric changes, and is frequently the seat of uneasy sensations, which are sometimes so severe as to merit the name of neuralgia. These symptoms occasionally depend on the trunk or branch of a nerve being involved in the cicatrix; but much more frequently no such cause can be discovered. In the former case, an operation for the excision or disentanglement of the implicated nerve could alone be expected to afford relief; and in the latter instance the usual treatment for neuralgia must be instituted.

CHAPTER VI.

WOUNDS.

The term wound, in the language of surgery, signifies a recent solution of continuity in the living structures induced by some mechanical cause.

Classification of Wounds.—Of the various divisions which have been made, an important one is the following—viz., wounds of the head, neck, thorax, abdomen, and extremities. The peculiarities of symptoms, dangers, results, and treatment depending on situation, will be mentioned in other parts of this work, where the affections of the particular regions are described; but, in the present chapter, we shall adopt the classification into incised, lacerated, contused, punctured, gunshot, and poisoned.

Various modes of Healing.—The various modes in which wounds heal, may be enumerated as the processes of adhesion, granulation and incrustation.

1. Adhesion—union by adhesion—union by adhesive inflammation, and union by the first intention, are the synonymes by which this mode of healing is referred to. For a description of this process, the reader is referred to the section on the results of inflammation, where, under the head of exudation of coagulable lymph, the opinions entertained regarding this mode of healing are mentioned. The conditions favourable for this mode of healing are—clean surfaces, unimpaired vitality, entire cessation of bleeding, perfect coaptation, exclusion of air, light dressing, and only a very slight grade of the inflammatory process. The treatment for adhesion will be afterwards considered.

2. Granulation is the mode of healing usually to be promoted when adhesion fails. The little conical eminences which form on the surfaces of suppurating wounds are named granulations, from their granular appearance, and serve for filling up the cavities and bringing together the edges of wounds, and uniting them by what is called the second intention.

As the processes of granulation and cicatrization have been already fully described, and as the treatment will come to be afterwards considered, it seems necessary in this place only to mention that this is the suitable, and, indeed, the only practicable mode of healing, when the wound is of such depth and extent that it is impossible to place or retain the surfaces in coaptation; when apposition is prevented by the presence of coagulated blood, or other foreign matter, which cannot be removed; and also when, in consequence of prolonged exposure to the atmosphere, or of any other cause, such as contusion, the inflammatory process has been made to reach the suppurative grade.

3. The incrusting or "modelling" process, better known by the familiar, though less euphonious name of "scabbing," is best adapted for wounds presenting a superficial denuded surface, perhaps of considerable extent, but of little depth. It comes into operation when, for want of inflammation sufficient to induce suppuration and granulation, or when, the vascular action of these processes having greatly subsided, a crust is formed on the surface of the wound by the drying, in the former case, of coagulated blood or fibrin, and in the latter, of fibrin and pus commingled. The crust may also be formed artificially, its use being to exclude atmospheric air, protection from the stimulus of which is essential to this process. Beneath this covering, new matter is added on the surface of the wound, raising its level, if depressed, and skinning it over when nearly on a plane with the surrounding integument; but the exact steps of the process are not fully ascertained. There is no suppuration, but merely a little serous discharge, oozing from beneath the edges of the crust. The cicatrix, when at last exposed, on detachment of that temporary covering, is more uniform, more similar to the original parts, and less liable to contraction, than a cicatrix obtained in any other way. If the inflammatory action increase during the process, suppuration ensues, and pus accumulates under the crust, raising it up and causing painful tension, and thus suspending, for the time at least, farther advance of the modelling process. Wounds heal very readily by this mode in the inferior animals, there being in them much less inflammatory tendency than in man. This mode of healing is most suitable for superficial wounds exposing a single surface, to which none other can be applied, provided there is no contusion of tissues, and little likelihood of inflammation. In deep wounds of uncomplicated character, the sides of which can be approximated, adhesion is more applicable and certain; while in one attended with loss of substance, so that coaptation is prevented, or in one of any form accompanied with much contusion, which must be followed by considerable inflammation, granulation offers the most available cure.

The crust, if not naturally formed, may be supplied artificially by covering the surface with lint, which soon becomes soaked with the oozing blood, and on drying, hardens into a strong, well-adapted covering; or the crust may be furnished by gently pencilling the surface with nitrate of silver, which coagulates the secretion. A piece of goldbeater's skin should be applied over, and for a short distance around, the thin pellicle thus formed by the lunar caustic, to prevent its premature cracking and detachment. Or the crust may be formed, as Professor Miller recommends, by using a "thick semifluid solution of gum tragacanth," which is laid uniformly over the surface, where it soon dries, forming an unirritating, transparent, and effectual covering from the atmosphere; which covering can easily be repaired at any part when necessary, and which, should undue vascular action set in, is softened and set loose by the discharge caused by the excess of inflammation. In the absence of the tragacanth solution, ordinary mucilage of gum acacia would form a similar, though probably a more brittle, and therefore inferior, pellicle. The part should be kept at rest, and, still further to assist in restraining local action, the antiphlogistic regimen should be enjoined. When the modelling process* fails, the treatment for granulation is to be instituted.

The Permanent Tissues of Repair.—With regard to the repair of injuries, it is known that in healing, the lesion of some textures is effaced by a reproduction of similar tissue, while the injury of other parts is repaired by the formation of a tissue less highly organized. Osseous and cellular tissue may be reproduced, and minute nervous and vascular filaments are formed in the connecting substance. The development of blood-vessels for granulations, or for superficial deposits of lymph, adhesions, or the like, has been referred to in the chapter on Inflammation, and the views entertained by many regarding their formation, have been mentioned; but in addition to the opinions already brought forward, it is proper to state, that, according to Mr. Paget, their development is always effected by the projection of *culs de sac*, commencing as mere dilatations, from a capillary arch passing close to the adventitious structure. These cœcal diverticula, crowded with corpuscles, are prolonged in a definite manner, towards and into the new tissue, so that they meet and adhere; the double partition formed by apposition of their closed extremities gives way, and a new capillary arch, transmitting blood, is formed. Fibrous tissue is the medium of repair in wounds of cartilage, in the cut extremities of which, however, bone is sometimes deposited. Muscular fibre, when divided, is never reproduced, cellular and fibrous tissues forming the new bond of connexion, which gradually contracting, in most instances, draw the retracted ends of the muscle at last into pretty close apposition. Nerves, when divided, if their cut extremities be in contact, rapidly unite, but with some confusion of function, apparently from the precise continuity of individual fibres not being accurately restored. Even when a considerable interval has occurred between the ends, union has been effected, in the first place by material similar to that effused after wounds of other soft tissues;

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* So named, it is said, because the new matter is added to the surface of the wounded part, so as to restore its original formation or model.

but, in time, nerve-fibres become developed within this substance probably by prolongation from the cut extremities, between which they form a communication, partially restoring the functions of the nerve. Not less, it is believed, than two years will suffice for the accomplishment of this process. There is "no example in which the nerve or ganglia corpuscles have been reproduced." The repair of wounds differs somewhat according to their amount of exposure.

In an open wound healing by granulation, all the parts become more or less matted together; but a subcutaneous incised wound, as practised on tendon, and properly treated, is much better regulated in its cure, and motion becomes free as before. The end of the tendon connected with the muscle retracts, and thus lies surrounded by healthy uninjured structures, quite removed from the site of the external wound. Liquor sanguinis is effused, and collects in greatest quantity, in that part of the sheath where there is most space, namely, that part vacated by the retracted tendon. The serum is absorbed, and the fibrin coagulates. In a few hours, those parts of the wound which are in coaptation, including the opening in the skin, subjacent cellular tissue, and sheath of tendon, become healed; but within the sheath, in the space between the ends of the tendon, fibrin exists in large quantity, chiefly derived from the muscular extremity of the tendon, which is the better nourished. By the usual process this becomes organized, and supplied with vessels. "About the tenth day," says Mr. Paget, "it is paler again, seemingly less vascular, and distinctly filamentous." These minute threads run on for some little distance, between those of both extremities of the original tendon, interlacing, and gaining a very firm connexion. In two or three weeks, the cure may be considered complete, continuity being quite restored, though still, for some little time, the new structure and its connexions are scarcely so strong as they ultimately become.

They equal, in this respect at least, any other part of the tendon, and, indeed, become quite undistinguishable from it. The cicatrix, after a wound, progressively improves in texture; new cuticle, or a structure identical with it is formed; but in the fibro-cellular tissue beneath, which occupies the place of the dermis, papillæ, when formed at all, are few in number, and imperfectly developed. After the lapse of several months, occasionally of more than a year, elastic tissue, similar to that of the original integument, but in very sparing quantity, is sometimes discovered.

INCISED WOUNDS.

Incised wounds are such as are inflicted with a sharp cutting instrument. This form of wound presents regular and smooth cut-surfaces, and is consequently best adapted for healing by adhesion.

The principal danger is from primary hemorrhage, which is greater in this kind of wound than in any other.

The Treatment of Wounds.—The treatment of wounds varies according to their nature, and the mode of healing desired. In this department of practical surgery, a great and salutary revolution has been effected within the last seventy or eighty years. This change had, for many years before the period above mentioned, been occasionally advocated by individuals, whose efforts, though at the time isolated, and apparently little appreciated, no doubt tended to the introduction of a more enlightened system. Thus Paracelsus, who flourished from 1493 to 1541, was, after Hippocrates, the first who advocated simplicity in the treatment of wounds, and in his writings, plainly asserted, that, in the healing of injuries, nature is supreme, and that the office of the surgeon is merely to protect the *vis medicatrix Naturæ* from hindrance or interruption. In 1542 the application of water-dressing to wounds was recommended in a paper by Blondus, published at Venice. But, probably, the first occasion, on which public attention was at all aroused, was by the cures, then deemed wonderful, accomplished at the siege of Metz, in the year 1553, by an empiric named Doublet, who employed linen dipped in pure water. In his practice its value was supposed to depend on certain charms and incantations pronounced over it. Shortly afterwards, Paré, the father of French surgery, adopted the water-dressing without the mummeries of incantation. Writers followed at intervals. The French military surgeons, Barons Percy and Larrey, in their campaigns, also proved its value. The late Dr. Macartney, in Ireland, ardently inculcated the use of water-dressing, and to his successful exertions much of the general adoption of that method of treatment is attributable. Very much is due on the same account in Great Britain to the late Mr. Liston, who, in his writings and practice, very strongly inculcated simplicity in every department of surgical practice: while eminent surgeons, yet alive, might be cited, who have contributed not a little towards obtaining for the simple and cleanly water-dressing, its present universal estimation. Even when adhesion is not desired, or attainable, the same application used warm, has, in the practice of very many, superseded the employment of the poultice.

The Treatment for Adhesion—with reference, chiefly, to incised wounds, comprehends *four* important indications, namely, to arrest hemorrhage—to remove foreign matter—to effect and maintain coaptation—and to guard against excess of vascular action.

The *first* indication is fulfilled, by aspersion of cold water, if mere oozing exists; or, by the ligature, when a distinct artery is seen pouring forth its contents. The ligatures, one end of each having been cut off near the noose, are brought out between the lips of the wound, by the shortest route; and if numerous, are arranged without entanglement into one or more bundles. These should, when otherwise convenient, leave the wound at its most dependent part; so that the slight purulent secretion, which is pretty certain to occur in their track, may find the most direct and easy exit, and, by at once escaping, not interfere mechanically with the process of adhesion in other parts of the wound. In amputations of the extremities, they are usually brought out at the angles of commissure between the flaps. The method of cutting off both ends of the ligature, and leaving only the knot, is now restricted, by almost all surgical authorities, to those cases in which the wound has no chance of uniting by the first intention.

Under the name of Acupressure, Dr. Simpson has proposed a new plan of arresting hemorrhage in surgical wounds and operations by the employment of metallic pins or needles instead of ligatures. As this is a subject of great practical importance, I think it advisable to insert the clear account of this method of arresting surgical hemorrhage, together with the arguments brought forward in support of it, in an interesting communication by Dr. Simpson, in the "Edinburgh Medical Journal" for the month of January, 1860. I shall take an early opportunity of making trial of this method, but cannot stop the press to give the result.

"The whole process consists in passing the needle *twice* through the substance of the wound, so as to compress together and close, by the middle portion of the needle, the tube of the bleeding artery a line or two, or more, on the cardiac side of the bleeding point. The only part of the needle necessarily left exposed on the fresh surface of the wound, is the small middle portion of it, which passes over and compresses the arterial tube; and the whole needle is withdrawn on the second or third day, or as soon as the artery is supposed to be adequately closed, thus leaving *nothing* whatever in the shape of a foreign body within the wound, or in the tissues composing its sides or flaps. To produce adequate closing pressure upon any arterial tube which it is desired to constrict, the needle must be passed over it, so as to compress the tube with sufficient power and force against some resisting body. Such a resisting body will be most frequently found, 1st, in the cutaneous walls and component tissues of the wound; 2nd, sometimes in a neighbouring bone, against which the artery may be pinned and compressed by the acupressure needle; and 3rd, in a few rare cases it may possibly be found in practice, that a second needle may require to be introduced to serve as a point against which the required compression is to be made. Most commonly the first of these three plans seems perfectly sufficient, and that even in amputation of the thigh. In acting upon this mode, the surgeon may place the tip of the fore-finger of his left hand upon the bleeding mouth of the artery which he intends to compress and close; holding the needle in his right hand, he passes it through the *cutaneous* surface of the flap, and pushes it inwards till its point project to the extent of a few lines on the raw surface of the wound, a little to the right of, and anterior to his finger-tip; he then, by the action of his right hand upon the head of the needle, turns and directs it, so that it makes a bridge as it were *across* the site of the tube of the bleeding artery immediately in front of the point of the finger, with which he is shutting up its orifice; he next, either with this same fore-finger of the left hand, or with the side of the end of the needle itself, compresses the locality of the bleeding arterial orifice and tube, and then pushes on the needle with his right hand so as to make it *re-enter* the surface of the wound a little to the left side of the artery; and lastly, by pressing the needle farther on in this direction, its point re-emerges through the *cutaneous* surface of the flap,—and the site of the tube of the bleeding artery is in this way left pinned down in a compressed state by the arc or bridge of steel that is passed over it. The needle thus passes first from and through the skin of the flap *inwards* to the raw surface of the wound, and after bridging over the site of the artery, it passes secondly from the raw surface of the wound *outwards* again to and through the skin. Sometimes the needle will be best passed by the aid of the eye alone, and without guiding its course by the finger-tip applied to the bleeding orifice. It compresses not the arterial tube alone, but the structures also placed over and around the *site* of the tube. When the needle is completely adjusted, all of it that is seen on the surface of the raw wound, and that not necessarily so, is the small portion of it passing over the site of the artery, while externally, upon the cutaneous surface of the flap, we have remaining exposed more or less of its two extremities, namely, its point and its head. The rest of it is hidden in the structures of the flap or side of the wound. The degree of pressure required to close effectually the tube of an artery is certainly much less than medical practitioners generally imagine; but in the above proceeding the amount of pressure can be regulated and increased, when required, by the acuteness of the angle at which the needle is introduced and again passed out,—the cutaneous and other structures of the flap serving as the resisting medium against which the needle compresses the arterial tube. But if it were ever, perchance, necessary to produce greater compression than can be thus accomplished by the needle alone, this increased pressure could be readily obtained by throwing around the two extremities of the needle exposed cutaneously a figure-of-eight ligature, as in hare-lip, with or without a small compress placed between the arc of the ligature and the skin. The process of the adjustment of the needle it is difficult to describe shortly by words; but the whole of it is readily seen and imitated when repeated upon a piece of cloth or leather. We fasten the stalk of a flower in the lapel of our coat with a pin passed exactly in this manner. To compress a bleeding artery against a bone is somewhat more complicated, but not much so. In accomplishing it, we have to introduce from the cutaneous surface a long needle through the flap of the wound obliquely to near the site of the artery, and then compressing, with the fingers of the other hand, or with the end of the needle, the part containing the artery against the bone, we make the needle, after passing over this compressed part, and after testing whether it has closed the vessel or not, enter into the tissues beyond, and if necessary even emerge from, the cutaneous surface on the other side at an angle somewhat oblique to that at which it entered; thus taking advantage of the resiliency and resistance of the soft textures to make them push the needle with the necessary degree of compression against the artery and bone. Arteries in particular parts require special adjustments and modifications to compress them against the neighbouring bone, which only experience can point out. There is always sufficient soft tissue on either side of the artery for the needle to get a purchase upon, to compress the arterial tube against the bone or other resistant point. In two cases, Dr. S. had found that branch of the internal mammary artery, which so frequently bleeds in the bottom of the wound after excision of the mamma, easily and perfectly closed by a needle passed through the flap to near the artery, then lifted over it and, after compressing it so as to stop the flow of blood, pushed onwards into the tissues beyond. Possibly, in some amputations, an acupressure needle or needles may yet be passed, immediately before the operation, half an inch or so above the proposed site of the amputation line, so as to shut the principal artery or arteries, and render the operation comparatively bloodless. If so, these needles would serve, at one and the same time, the present uses of both tourniquet and arterial ligatures Perhaps this will be found, in some cases, a simple and effectual means of compressing and closing the artery leading to an aneurism,—as the femoral artery, for example, in popliteal aneurism,—changing the operation for that disease into a simple process of acupuncture instead of a process of delicate dissection and deligation, when in any case the milder methods of compression, manipulation, and continuous flexion of the limb fail. It has been hitherto a difficult problem to obstruct the vessels of the ovarian ligament in ovariotomy, without leaving a foreign body, whether clamp or ligature, upon the stalk of the tumour, to ulcerate and slough through it. If the stalk be transfixed and pinned in its whole breadth to the interior of the relaxed abdominal walls, by one or more acupressure needles passed through these abdominal walls from without, this difficulty may possibly be overcome.

That needles used for the purpose of acupressure, and passed freely through the walls and flaps of wounds will not be attended by any great degree of disturbance or irritation, is rendered in the highest degree probable by all that we know as to the tolerance of the contact of metallic bodies by living animal tissues. Long ago, John Hunter pointed out that small-shot, needles, pins, etc., when passed into and imbedded in the living body, seldom or never produced any inflammatory action, or any at least beyond the stage of adhesive inflammation, even when lodged for years. Some time ago, when the subject of acupuncture specially attracted the attention of medical men, Cloquet, Pelletan, Pouillet, and others, showed that the passage and retention of long acupuncture needles was attended with little or no irritation in the implicated living tissues. The Reviewer of their works and experiments in the "Edinburgh Medical Journal" for 1827, observes,—"It is a *remarkable* circumstance that the acupuncture needles never cause inflammation in their neighbourhood. If they are rudely handled or ruffled by the clothes of the patient, they may produce a little irritation ; but if they are properly secured and protected, they may be left in the body for an *indefinite* length of time without causing any of the effects which usually arise on account of the presence of foreign bodies. In one of M. Cloquet's patients, they were left in the temples for 18 days ; and in cases in which needles have been swallowed, they have remained without causing inflammation for a much longer period. It appears probable, from the facts collected on the subject, that metallic bodies of every kind may remain imbedded in the animal tissues without being productive of injury."—(Page 197.) All the late observations and experiments upon metallic sutures are confirmatory of the same great pathological law of the tolerance of living tissues for the contact of metallic bodies imbedded within their substance. In the operation for hare-lip, where the whole success or failure of the operation depends on the establishment or not of union by the first intention, surgeons use needles to keep the lips of the wound approximated, often compressing these needles strongly with their figure-of-eight ligatures, and find this measure the most successful means which they can adopt for accomplishing primary adhesion.

The Acupressure of arteries, when compared with the Ligature of them, appears to present various important advantages, as a means of arresting hemorrhage,:—1st. It will be found more easy, simple, and expeditious in its application than the ligature. 2nd. The needles in acupressure can scarcely be considered as foreign bodies in the wound, and may always be entirely removed in two or three days, or as soon as the artery is considered to be closed ; whilst the ligatures are true foreign bodies, and cannot be removed till they have ulcerated through the tied vessels. 3rd. The ligature inevitably produces ulceration, suppuration, and gangrene at each arterial point at which it is applied ; whilst the closure of arterial tubes by acupressure is not attended by any such severe consequences. 4th. The chances, therefore, of the union of wounds by the first intention should be greater under the arrestment of surgical hemorrhage by acupressure than the ligature. 5th. Pyæmia and surgical fever seem not unfrequently to be excited by the unhealthy suppuration, etc., in wounds which are liable to be set up by the presence and irritation of the ligatures. 6th. These dangerous and fatal complications are less likely to be excited by the employment of acupressure, seeing the presence of a metallic needle has not the tendency to create local suppurations and sloughs in the wound, such as occur at the seats of arterial ligatures. 7th. Hence, under the use of acupressure, we are entitled to expect both, *first*, that surgical wounds will heal more kindly and close more speedily; and *secondly*, that surgical operations and injuries will be less frequently attended than at present by surgical fever and pyæmia."

The *second* indication, which is to remove all foreign matter, including coagulated blood, should be attended to as soon as active bleeding has been suppressed. Were its fulfilment neglected, adhesion would in consequence be prevented.

All oozing having been completely arrested, foreign matter removed, and the surface of the wound having taken on a glazed appearance;—the *third* indication,—namely, to effect and maintain coaptation, should next be proceeded with. Such are the conditions which render coaptation advisable; and with regard to the means employed for effecting it, they are position, plaster, sutures when necessary, and, in some particular circumstances, carefully adapted pressure.

The position should be such as will best relieve tension of the muscles and integuments, and obviate venous congestion. A greater amount of relaxation is necessary in some wounds than in others. As muscles are the principal agents in causing retraction, and in preventing easy coaptation, the general rule is to put the limb or part into the position that would be given to it by the natural contraction of the wounded muscle. When muscular fibres are cut transversely, there is much greater retraction, and consequently more necessity for the observance of a position that will secure relaxation, than when the wound runs parallel to, or between them, in which case relaxation might be carried too far, by making the sides of the wound bulge loosely, and thus prevent accurate coaptation. In such cases, the parts should be laid so as sufficiently to relieve tension, without permitting undue laxity. In amputation wounds of the limbs, where little relaxation is necessary, more than is already present, elevation, to such a degree as to prevent congestion, is the chief point of consequence with regard to position.

Of retentive appliances, *plaster* is one of the most generally useful; and of the various kinds of plaster, the best, though unfortunately also the most expensive, is that which was introduced into practice by Mr. Liston, and known by the name of isinglass plaster. It consists of gauze or silk, which being stretched out, is frequently coated with a film of isinglass, until the adhesive layer be of the requisite thickness; after which the other side is turned up and varnished with boiled oil. Its advantages are these,—the isinglass is perfectly non-irritating to the sound skin and its cut margins; the oiled gauze is transparent, and accordingly does not conceal the state of matters below; it is very easily applied, having only to be moistened with warm water; it soon dries, becoming firmly adherent; and the impervious nature of its varnished tissue prevents any moisture from the outside detaching it. When the wound is discharging, the plaster becomes loosened immediately over the edges, and for a little way beyond; but this is really advantageous, as it favours free escape of secretion from between the lips of the wound; and the loose central portion stretching a little, allows room for the slight tumefaction which generally exists in some degree, when any discharge is being poured forth. On the other hand, cheapness is the sole recommendation of the common plaster, composed of emplastrum plumbi, with resin added to make it sufficiently adhesive. From the nature of the latter ingredient, this plaster is irritating to the skin, and so favours inflammation and erysipelas. It does not adhere firmly when the skin is at all moist; the calico on which it is spread being opaque, hides from inspection the parts beneath; and when any ill-conditioned fœtid pus comes from the wound, the plaster, if carelessly prepared, becomes blackened by the formation of sulphuret of lead, which smears the parts beneath; in the removal of which layer, as cleanliness demands, more washing and sponging are required than can be beneficial to the delicate margins of the wound. By slow boiling, however, for double the usual time, plaster may be made pretty adhesive without the addition of the irritative resin.

The strips of plaster, varying in breadth according to the size of the lesion, are applied at intervals about as wide as the strips, while the assistant carefully holds the parts in the most favourable position for coaptation, and gently presses the cut surfaces and edges into apposition. The intervals left between the strips of plaster permit the escape of any secretion of serum or of pus, if afterwards formed; and, it is in these intervals that sutures and the extremities of ligatures are, when employed, to be placed. The slips should be long, so as not merely to hold the edges in contact, but, by their adhesion to an extensive surface, to keep the parts well together. In longitudinal wounds of the extremities, however, they should not be so long as completely to encircle the limb, as they would then constrict it, prove hurtful and provocative of inflammation and œdema, by obstructing venous return, and by rudely opposing the slight swelling which takes places in every large wound, even although adhesion be attained.

Instead of isinglass plaster, strips of linen dipped in, or spread with collodion, have lately been employed. This substance, made by dissolving gun-cotton in ether till the solution be of a syrupy consistence, dries very rapidly when spread out, in consequence of the evaporation of the solvent; and in so doing, it contracts and tightens, leaving a transparent and colourless layer which adheres very firmly to the skin, and is unaffected by and impervious to any of the ordinary fluids naturally or artificially present about a wound. To procure its thorough adhesion, the skin must be quite dry at the moment of application. In cutaneous wounds, after the strips are dry and adherent, if there be no oozing of serum from the cut, a little collodion may be smeared in the intervals over the margins; by which means the edges will be preserved in contact, and protected from atmospheric irritation. The collodion may be tinted any colour, and it is worthy of remembrance, when large quantities of it are used, that it is highly inflammable, and that the dry substance left by evaporation of the ether, is quite as combustible as the gun-cotton before its solution; except that its now more compact and solid form renders combustion or explosion less rapid than in its original fleecy state. A substance closely resembling collodion in its properties and capabilities of application is prepared by dissolving certain proportions of gutta percha and caoutchouc in chloroform, and is used in precisely the same manner. A third substitute for the isinglass and common adhesive plaster has lately been employed. It consists of a thick semifluid solution of gum-lac in alcohol, which may be prepared and kept in a wide-mouthed bottle with a closely fitting cork. It is more economical than collodion, is employed in the same manner, and is represented as being quite as efficient. It has, along with the gutta percha solution, the disadvantage of not being, like collodion, altogether colourless; but is said to possess, over both these preparations, this advantage, that moderate moisture does not prevent its adherence. All of these solutions, when applied to a raw surface, excite momentary smarting.

Sutures, the next of the retentive apparatus, should not be employed, when it is possible to maintain steady apposition without them. During the first day or two, and before they have cut their way by ulceration through the skin, they certainly act more powerfully than plasters in maintaining coaptation,—one of the essentials for obtaining adhesion; but they irritate much more, and, if not speedily removed, excite, at least in their immediate vicinity, sufficient inflammation to lead to ulceration, preparatory to their spontaneous extrusion; and the vascular action thus set up in one part of a wound, may extend so far as materially to interfere with or prevent adhesion. Even under the most favourable circumstances, a slight suppuration seldom fails to follow in the track of each stitch; and though, when the action stops here, the general healing of the wound may not be retarded, still the greater marking of the cicatrix, at each of these points, is an additional reason for avoiding their employment when possible, especially on exposed parts. Sutures, then, are to be employed when there is difficulty in keeping the parts satisfactorily in contact by means of plasters: but they should be as "few and far between" as consists with the attainment of their immediate object. They are introduced before the plasters are applied; and on each side, but not over them, the strips of the latter should be placed. For deep wounds, and for those of irregularly shaped parts, the *interrupted* stitch is usually employed; though, for the former class, the *quilled* suture is sometimes recommended; and for wounds in some situations, as will be explained in a future chapter, the *twisted* suture is the best.

The sutures should, in all instances, be removed as soon as it can be done without endangering the separation of the parts. If the structures be lax and easily kept together, they may be cut and removed at a very early period; as soon, indeed, as the plasters have become dry and strongly adherent: but if there be tension in the lips of the wound, the whole, or some of the stitches must be allowed to remain until the parts have become somewhat moulded to their new relations, and partially adherent. In all cases early removal is desirable, although in many, when the parts are not on the stretch, they do not produce much excitement. Again, if severe inflammation attack the wound, the sutures must be snipped and withdrawn, as their presence would only increase the mischief:—they would soon be set free by ulceration; but before this was accomplished the undue constriction, which they must have exerted on the tumefying wound, would stimulate the local action and aggravate the pain.

Dr. Sims, of New York, has done great service in this department of practical surgery, by calling special attention to the advantages of sutures of silver wire over those of silk or linen thread. They are much less irritating; and from my own experience I am satisfied that the great advantages will be realized from them which this distinguished surgeon has led us to expect. For their introduction in all ordinary exposed situations Professor Lister's needle, grooved on the side, will be found exceedingly convenient. For their introduction into the vivified lips of a vesico-vaginal fistula particular forms of needles have been devised; and the results of the use of metallic sutures in this department certainly constitute one of the greatest triumphs of modern surgery.

Instead of the suture, M. Vidal employs a little spring forceps, about an inch and a half in length. Its points are so far blunt, that though they take hold of the skin, they pierce no more than the cuticle at most. It produces little or no irritation, and, when removed, leaves no mark. Another and smaller forceps, on a similar principle, but only about three-quarters of an inch long, is also employed in Paris. In venereal cases, in which circumcision is there frequently performed, the glans penis is surrounded with, as it were, a corona of these forcipes, the points of which keep the cut margins of the delicate skin and mucous membrane in most intimate contact, and the wound speedily heals with a cicatrix scarcely perceptible.

In many, indeed in most wounds, no other retentive apparatus than suture and plaster need be employed; but in certain cases, when the wound is very deep, and its sides exceedingly loose,—conditions occasionally co-existent in persons of flabby fibre, and which favour the accumulation of secretions between the parted sides,—it may be advisable to surround the wounded part with a turn or two of a bandage; under which, but not over the mouth of the wound, a soft compress may sometimes be placed with advantage. The roller, at this early stage, must, however, be applied very lightly; so that it shall merely assist in giving support, and in preserving apposition of every part, deep as well as superficial; and operate more as a precautionary measure to prevent displacement during any irregular muscular twitching, than as an immediate means of retention. Gentle support—not actual pressure, which would be injurious—is wanted; and the better to avoid this evil, it is well to damp the bandage previous to application; for the dry fibre soon imbibes moisture from the integument or the wound, and, in so doing, grows thicker and shorter, so as ultimately to become much tighter than when applied, or than was intended.

The retentive apparatus having been thus applied, the wounded part is to be laid in a suitable position, combining relaxation and elevation. The latter is the point chiefly to be attended to after amputation; and, for this purpose, the stump or other part is laid on a soft pillow, or any convenient rest, over which, for the sake of cleanliness, is spread a piece of oilcloth, or of thin sheet gutta percha, in order to prevent the parts beneath being soaked with any discharge. Along the margins of the wound, when large, a single strap of soft linen is placed, and kept moist with cold water; but in smaller and more sheltered injuries, this may be omitted. When the wounded part lies beneath the bedclothes, their pressure and heating effect must be prevented by a suitable cradle.

All that now for some time requires to be done, is merely to keep the parts clean, wiping away any fluid secretion from the neighbourhood of the wound, but never actually touching its raw and tender margins except with water. These matters being attended to, the part is to be kept, as far as possible, at perfect rest.

Supposing all to go on well, tho stitches, if such have been employed, are removed at the proper time, as before explained; but the plasters may possibly, in a large wound, require occasional renewal, owing to the fluid secretion trickling down and loosening their dependent extremities, or from their becoming unduly loose as the rocess of adhesion goes on, and the edges spontaneously approximate more perfectly. When, from any of these causes, it becomes ecessary to change the plasters, they should be seized by both their xtremities, and raised from each end towards the centre, which verlies the line of wound, and from this, lastly, they are with gentleess to be lifted. If, on the contrary, the strip were seized at one nd, and pulled off along its whole course towards the other, it is obvious hat after passing the central part, it would, if at all adherent, be apt to tear away the edge of the wound covered by its last half, from that margin to which its first raised portion had been applied. In renewing plasters, no more than one or two of the old strips, however loosely adherent, should be removed at once, before supplying their place with new pieces; and as each slip is taken away, the vacancy is to be filled up before detaching another. This precaution is necessary, because if all the strips were removed at once, the wound, being unsupported, might fall open, and the tender adhesions—the work of several days—be in an instant destroyed. Any necessary moving of the wounded part, whether for correcting malposition, cleaning the support on which it rests, or applying fresh plasters, must be conducted with great care and gentleness.

When ligatures have been employed, some of them will probably be loose by the end of ten days. Accordingly, about the expiry of that period, each ligature, except that on the main artery, which should be left undisturbed for at least a week longer, may be carefully isolated from the others, and gently pulled by the fingers or forceps. If loose, it will come away immediately; if, however, the slightest resistance be felt, no force must, on any account, be used; but the delay of a few days be allowed before it be again tried. The utmost gentleness is to be observed in this proceeding, lest the ligature should be drawn away before perfect occlusion of the vessel has taken place; but with this precaution, it is better to try the ligatures, and remove them when loose, as, if left to themselves, they might remain in the wound long after they were detached, and thus retard its complete healing.

Perfect healing, after adhesion has progressed favourably for about a week, is often retarded by an œdematous swelling, the result of undue vascular relaxation. In these circumstances, a bandage is to be applied, so as to give support, and exert a moderate degree of pressure. This, however, must neither be severe nor unequally disposed, because in either case it would excite irritation, and the swelling of œdema would soon give place to that of inflammation.

It must always be remembered, that at any stage, however late, excess of vascular action may set in, and prevent the further progress of adhesion, or even destroy the union already effected. It is frequently induced by cumbersome dressings, officious sponging and rubbing of the wound, and by an over-stimulating diet.

The *fourth* indication, which is, to repress inflammatory action, is fulfilled, partly by the simple local treatment just detailed, and partly by treatment directed to the system in general. The strict antiphlogistic regimen should be enforced, all stimuli removed, and perfect rest, general as well as local, enjoined. The food must be small in quantity, unstimulating in character, and given pretty cold. In the case of feeble persons, and of those at an advanced period of life, the antiphlogistic regimen must, however, be instituted with great caution, and its effects closely watched; but, in regard to these and many other points, the surgeon must be guided by the peculiar circumstances of each particular case.

All these things may be attended to, and the desired result may not be attained, in consequence of neglect of the hygienic conditions by which the patient should be surrounded. "To keep the air the patient is breathing as pure as the external air without chilling him," free admission of light, a proper condition of bed and bedding, perfect cleanliness of person, room, walls, and utensils, the removal of everything from which injurious effluvia could by any possibility proceed, suitable food given at suitable periods, avoiding everything that causes fatigue to the patient, and judicious arrangements for rest and sleep, are some of the many conditions that are essential, and the neglect of which is often punished with erysipelas, pyæmia, dysentery, and other sorrowful results.

Treatment for Granulation.—Wounds may require to be treated for granulation, either when inflammation has proceeded too far in a case which it was first attempted to heal by adhesion, or when, from the beginning, it was evident that granulation was the most suitable mode of healing, whether owing to loss of substance preventing coaptation, or too extensive contusion, or to the presence of foreign matter which could not be removed; all of which conditions are incompatible with the attainment of adhesion, on account of the active inflammation to which they give rise

In the former case, that of a wound treated hitherto for adhesion, its edges become swollen, red, and painful. Swelling more deeply-seated causes the margins to separate, and purulent matter is soon poured forth. The indication here is to repress inflammation; in fulfilment of which, all sources of local irritation and general stimulation must be withdrawn. Sutures, if present, should be removed, and only a few strips of plaster left, to prevent any unnecessary gaping of the wound, and in many cases they also must be dispensed with. To the parts thus relieved from every kind of local irritation, warm water dressings are applied, or a light, soft, moist, and warm poultice, if that application be still employed.

In the second case, where granulation is from the first considered to be the most available mode of cure, the treatment is essentially the same as that mentioned above. The part is elevated, and kept at perfect rest; no sutures are employed, and only a few strips of plaster are used to connect the more loose portions of the wound. Cold water-dressing is applied till oozing of blood ceases; it is then gradually changed to the tepid, and next to the warm dressing, as the vascular action rises, so as to soothe and relax the tumefying wound. When the inflammation proves so active as to threaten gangrene, it must be repressed by local bleeding, and if absolutely necessary, by more energetic remedies, in addition to the antiphlogistic regimen, which during this stage of acute inflammation is to be adopted.

In both cases the same point is now reached. Warm dressings are continued so long as inflammation remains active; but as it subsides, the heat of the dressing is gradually lowered until it be again merely tepid, or even cool.

Under this treatment, the surfaces, if matters go on favourably, become clean in a few days; granulations spring up, and healing advances. The discharge, which, during the height of the inflammation, had been very profuse and far from laudable, now diminishes in quantity and improves in quality. In these circumstances the wound, when superficial and broad, rather than narrow and deep, requires merely the treatment proper for an ordinary ulcer; comprising the water-dressing, medicated, when necessary, with metallic salts, to stimulate indolent granulations, and the employment of carefully adapted pressure with a bandage, when necessary to repress œdematous swelling.

But if the wound be deep, without much loss of substance—in fact, such a case as would have healed by adhesion had not inflammation prevented—then, at this stage, when the surfaces are granulating well, and secreting little pus, they will, if placed in mutual contact, speedily cohere, affording a most satisfactory and rapid cure by secondary adhesion. Plasters are employed to retain the parts in apposition, and a bandage lightly and uniformly applied, is in general necessary to give support. As absolute local rest is necessary for healing, any neighbouring joint which interferes with this essential condition in the wound, must be prevented from exercising its natural functions, by a splint fastened with a few turns of a roller, or with a buckle bandage applied at two or more points, lightly, so that no œdema may ensue on the distal aspect, and arranged so that neither splint nor bandage shall compress the injured parts, or come in the way of the requisite dressings. Cleanliness is throughout attended to; the actual edges of the wound are not touched, but from all around them the discharge is frequently wiped away with a small dossil of clean lint, tow, or rag, or indeed of anything clean, soft, and absorbent. A good sponge answers well when there is only one wound to dress, because it can then be frequently washed: but in hospital practice it would come into contact with all kinds of sores, and would never be sufficiently well or often cleansed after each time of its employment.

On the other hand, the morsel of tow, being of small value, may be destroyed, and a fresh piece employed on each occasion.

The constitutional treatment — which during the height of the inflammation comprised at least the antiphlogistic regimen, and sometimes also local or general bleeding, according to circumstances— consists now, while matters are going on favourably, in attention to the secretions, and avoiding both undue stimulation and hurtful abstinence. In individuals of debilitated constitution, and even in persons previously of good health, when the wound is large, suppuration may continue profuse, cicatrization proceed very slowly, and the secondary adhesion fail. Under these circumstances, the diet must be full and nutritious, with a due allowance of stimuli. In severer cases this generous regimen must be farther assisted by the exhibition of medicinal tonics. Though the part itself must be kept at rest so that it may heal, yet it may be much benefited indirectly by appropriate general exercise with the view of strengthening the system.

LACERATED WOUNDS.

Lacerated wounds are produced by a blunt body being driven into and through the textures, or by a moving body becoming attached to a part and tearing it away. In both cases the edges are ragged and uneven, the parts being torn rather than cut; in both there is considerable straining of the surrounding structures; and in the former an amount of contusion is inflicted by the body entering and passing through the tissues. This dragging and bruising of the parts weaken their vitality. From the depression of the nervous system in severe cases of this nature, there may be little pain. So much, indeed, is this the case, that an arm has been torn off by machinery, and yet the person has for some time experienced little or no pain. There is in general, also, but little hemorrhage, partly because the surface of the wound being irregular, the blood is very apt to adhere and become coagulated; partly because the vitality of the vessel has been diminished by the straining. But the chief reasons why arteries bleed less when lacerated than when cut, are, that when torn, the coats do not retract equally, the inner and middle coat contract and retract within the external tunic; the external coat next retracts within the sheath to a less degree; and the sheath forms a conical cavity beyond the outer tunic. These conditions are obviously much more favourable for the arrest of hemorrhage than the uniformly retracted coats of a cut artery. Although the pain may often be slight at first, and although there may be little primary hemorrhage, these wounds are ultimately much more dangerous than those of a simple incised character. They are very apt to be followed by severe inflammation; and if there be much bruising, by sloughing: they are more liable to be followed by severe constitutional disturbance, and by tetanus; and, if gangrene ensue, there is danger of secondary hemorrhage on the separation of the slough.

In the case of a purely lacerated wound, or when contusion, though present, is so only in a very slight degree, adhesion is possible, and ought to be attempted; and if it should fail, from inflammation running too high, the wound is still as much disposed for granulation as it would have been, had adhesion not been tried. Besides, a part of the lesion may adhere and remain united, even while granulation occurs in the remaining portions.

The *treatment* of those wounds which are purely lacerated in their character, or at least attended with extremely slight contusion, is, with some modifications, the same as that already related as conducive to adhesion. Sutures should, if possible, be still more avoided than in simple incised wounds, and isinglass plaster chiefly trusted to for maintaining coaptation, so as to diminish, to the utmost, all sources of local irritation. Absolute rest of the part, and usually of the whole body also, is requisite. The water-dressing is applied cold or nearly cool, for the latter is usually more agreeable to the feelings of the patient. If the attainment of adhesion be peculiarly desirable, it may be necessary, in addition to the abstraction of all sources of local or general excitement, and the rigid observance of the antiphlogistic regimen, to take blood from the part, or even from the system, in order to keep the inflammation within proper limits. Under this treatment many such wounds heal partially, if not altogether, by adhesion. Should, however, inflammation prove too active, a change should be made to the treatment for granulation.

CONTUSED WOUNDS.

Contused wounds are caused by very blunt bodies passing in a tearing manner through the tissues, inflicting in their passage a large amount of contusion and straining. They are, in general, merely lacerated wounds, accompanied by much contusion; but this complication renders them more dangerous, more tedious to cure, and productive of greater deformity. When the bruising is very decided and instantaneous, there is usually not much pain. This circumstance, however, is merely a symptom indicating that the contusion is very severe; for if it be but slight, the pain may be pretty acute. The primary hemorrhage is seldom considerable; but bleeding may occur to a dangerous extent on the separation of sloughs. In severe cases, there is considerable collapse, and reaction is proportionately violent. Excessive inflammation attacks the wound, and gangrene not unfrequently occurs, sometimes to a large extent, especially in vitiated constitutions. A large sore follows the loss of substance, suppuration is profuse, and may be so prolonged as to induce hectic fever. Or pyæmia may occur, and typhoid symptoms become developed.

The *treatment* of wounds, in which the contused character prevails, is regulated with a view to granulation. The bleeding having ceased, foreign matters being removed, and the wound cleansed, the part should be placed in a position that combines relaxation with elevation, both these conditions being calculated to relieve the supervening local action. Sutures are useless, and the irritation caused by them would be injurious. Even plasters are unnecessary, except when the wound has a strong tendency to gape widely, or when, at some parts, the contusion having been slight, there may be some hope of partial adhesion, on coaptation being effected. Warmth is applied either by means of cloths dipped in warm water, or by means of a soft, light poultice, in which the bruised part is imbedded. Neither application must be allowed to become dry or cold, but is to be renewed as frequently as may be requisite.

When the inflammatory action runs high, depletion—local and general—may be necessary to repress its violence, and limit the consequent amount of sloughing. But this part of the treatment must always be conducted with the greatest caution, remembering that ere long the system may be taxed to the utmost in maintaining suppuration from an extensive surface, and which may, by long continuance, induce hectic fever before cicatrization be effected.

During the progress of the inflammation, diffuse abscess occasionally occurs, and must be evacuated by free incisions. As the slough separates, the patient should be watched, lest secondary hemorrhage should occur; and after the separation, the proper treatment instituted. The warmth of the applications should of course be reduced when the process of granulation commences, as the relaxing effects of the heat would then be injurious. Amputation may be necessary when there is very extensive crushing of the soft parts, or comminution of bones; and also when the gangrene is very extensive, accompanied by proportionate constitutional disturbance.

The *constitutional* treatment scarcely needs to be recapitulated. During collapse, if long persistent, stimuli may be required, yet should be given as sparingly as consists with the attainment of the object for which they are given, and not to such extent as to aggravate the subsequent reaction and its consequences. During the height of the inflammation, the antiphlogistic regimen should be adopted; and, when necessary, local or general bloodletting, according to the violence of the action, but in every case with great caution.

PUNCTURED WOUNDS.

Punctured wounds are produced by the penetration of a narrow and pointed object into the tissues,—usually to a depth disproportionate to the small aperture of entrance. According as the point of the instrument is sharp or blunt, and its blade thin and flat, or thick and bulky, will the injury partake chiefly of the physical characters of an incised wound, or of those of the lacerated, and contused varieties; that is to say, the wound has some of the characters belonging to each of these three species, and according as one or other predominates, the lesion is more or less serious. Unless some very important organ has been injured, the shock is less marked in this than in some other kinds of wound; but whenever the weapon has passed far and deeply into any tissues, the lesion must be considered to be of a serious character, more particularly, as it cannot at first be known what parts have suffered, and what have escaped. There may be at the time little primary hemorrhage, although a considerable artery has been wounded, because of the form of the wound being unfavourable to the free exit of blood. In such a case, however, the blood is certain to break out speedily, and even although no large vessel be wounded, there is still the danger of secondary hemorrhage, if there has been bruising to an extent calculated to lead to inflammation and sloughing. Nerves likewise may be *cut*, *torn*, or *punctured*, and consequently for this reason, as well as for others, tetanus is more to be dreaded in these wounds, than almost in any of the other varieties.

Very violent inflammation usually follows punctured wounds of any considerable depth; not only on account of the mode of their infliction, but also because the blood, which oozes from the surface, does not meet with a ready exit, but remains coagulated, forming a layer of foreign matter, or becomes infiltrated into the soft tissues, chiefly the cellular. Inflammation is further favoured by the probable lodgment of extraneous bodies; perhaps of a portion of clothing driven in before a blunt-pointed weapon, or of the sharp point of a more delicate instrument which has been broken off against a bone that resisted its farther progress. Violent inflammation is pretty certain to follow punctured wounds of synovial and serous cavities, of dense fibrous structures, and of the scalp, in which latter situation it usually assumes the erysipelatous form. When of considerable depth, several layers of aponeurosis are generally traversed; and these unyielding structures, by tightly confining the parts beneath, and preventing their tumefaction as vascular action rises, aggravate the subsequent inflammation; while the matter, not finding sufficiently free vent, is very apt to burrow along the muscular interspaces beneath the fasciæ, and give rise to diffuse purulent infiltration of the cellular tissue.

The *treatment* of punctured wounds varies according to the depth of injury, and the amount of accompanying contusion and laceration. When the wound is of small depth, attended with little or no bruising, and is free from foreign matter, adhesion is possible, and should be promoted. Till oozing ceases from the external orifice, cold aspersion is to be practised. When no more blood issues, any little apposition required by this form of wound is to be effected, and a piece of isinglass plaster placed over the opening, so as to cover it entirely, or with the exception of the most dependent point. The patient is to be kept quiet, and restricted to the antiphlogistic regimen. Under this treatment, most of these slight wounds heal: but if the case be a little more severe, the cold water-dressing, or a cooling saturnine lotion may be applied; still, however, retaining the morsel of plaster, so as to preserve the actual margins of the wound from irritation, and to prevent the liquid application from insinuating itself along its track. A single layer of moistened lint is employed, but without oiled silk above it, as the object is to encourage rapid evaporation, and procure its refrigerant effect.

In more serious cases the treatment becomes, in a corresponding degree, complicated. Thus, if hemorrhage takes place from a wounded vessel, which cannot be reached on account of its deep situation, and the narrowness of the wound—while pressure fails to arrest it, or, owing to the peculiar situation of the injury, cannot be employed—then the wound must be dilated by careful incision to the required extent, and in the safest direction, so as to permit the artery to be tied above and below the point of lesion. Dilatation may also be requisite, when foreign matter has lodged in the wound, the presence of which will be ascertained by learning the mode of infliction, by inspecting the weapon, or, if necessary, by the gentle use of the probe. The foreign substance may then be removed by a forceps, or any convenient instrument.

It was formerly the custom to dilate every punctured wound by tents and plugs. More recently, simple incision was substituted, in the hope of transforming the lesion into a mere incised wound, which, as has already been seen, is of a much more simple character. This indiscriminate use of the knife is now justly abandoned, and dilatation is practised at this early stage only with a view to permit the ligature of a bleeding vessel, or the removal of foreign bodies; and, at a later period, to effect evacuation of matter, and thus afford relief from tension. The wound being now free from extraneous substances, its edges are brought gently together, and cold water is applied till oozing ceases. Apposition is then effected, and preserved by one or more slips of isinglass plaster; and cool water-dressing applied, to prevent undue vascular action.

Subsequently, when pain, tension, and inflammation ensue, and prove severe, warm fomentations, medicated if necessary with opium, are applied to soothe and relax the parts. Adhesion not having taken place, the subsequent treatment is adapted for granulation. In cases still more severe, abstraction of blood from the parts around the wound, and from the system, may be necessary to limit the action and sympathetic disorder of the constitution. When deep-seated inflammation occurs, particularly when under dense fasciæ, indicated by severe pain, diffuse swelling, and hardness, then early and free incisions are demanded, to relieve tension and afford free vent to matter.

The *constitutional* treatment, which in punctured wounds frequently requires to be pretty active, is conducted on the same principles which have so often been referred to in the pages immediately preceding, and therefore need not here be recapitulated.

GUN-SHOT WOUNDS.

Gun-shot wounds, the most frequent injuries in modern warfare, are inflicted by shot projected from pistol, musket, rifle, or cannon, by splinters of wood or stone, shattered by an impinging ball, and by fragments of iron, or other substance, scattered around on the explosion of shells. They present, according to the nature of the penetrating body, various degrees and combinations of contusion, laceration, and puncture.

With regard to these injuries, there are many circumstances which require to be understood. A ball projected through the air, proceeds at first with great force and rapidity, nearly in a rectilineal direction; and if it come, during this part of its course, in contact with any portion of the body, it either penetrates and lodges, or passes directly through, or carries the part away, according to the force and size of the shot.

After a time, the ball describes a curve, called the parabola; its velocity diminishes, and it acquires a new motion of rotation on its own axis. In this stage, very slight obstacles deflect it from its course, and should it now impinge against the body, the ball, even though large, may not sweep away the opposing part, but merely be turned aside, rolling over the surface, and inflicting, in proportion to its remaining momentum, a dreadful amount of contusion. This is indicated by the cold, soft, and flaccid feeling of the part, and its diminished or destroyed sensation. Such is the explanation, as given by Larrey and modern military surgeons, of those cases of violent bruising of the soft parts, fracture of bones, and dangerous or instantaneously fatal concussion of internal organs, by large shot, frequently without laceration of the integuments, or the infliction in rapidly fatal cases, of any outward sign of injury. These accidents were formerly attributed to the "wind of the shot," caused by its passing with extreme velocity close to the body; but they are now with more accuracy referred, as above, to the actual contact of "spent balls."

The aperture of entrance made by a ball is much smaller than that of exit; and, owing to the elasticity of the integument, is very generally much smaller than the shot which actually entered, while its margins are inverted and uneven. The margins of the aperture of exit are everted, and more ragged than the former. When discharged either at a very short or long distance from the body, a ball enters more roughly, and produces a more ragged wound than when it strikes in the middle of its range. At its entrance, and during the first part of its course through the tissues, its transit is chiefly characterized by contusion; while farther on, and towards its exit, its effect is more purely laceration. In the former part, therefore, sloughing is more probable.

In the stage of diminished momentum, the shot, if small, may also be deflected, when it impinges very obliquely upon the surface; or, piercing the integument, it may proceed beneath it, sometimes along the trunk, or the hollow aspect of a limb during flexion, sometimes partially or completely round either; or penetrating more deeply, it may enter the thoracic or abdominal cavities, and course around their interior circumference, without wounding the contained viscera. It is, in fact, deflected from its straight course, when the obstacles to its direct continuance are greater than to slight deviation. From these circumstances, it happens that the course of balls is very uncertain. A button, or other hard appendage of the dress, and the common articles usually contained in the pockets, have frequently repelled, arrested, or deflected a ball, to the manifest preservation of life. Sometimes, on the other hand, these bodies are forced into the tissues before the bullet.

After penetration, their course is not more certain. Bone, and softer structures may alter their direction; and the elasticity of the common integument often confines them after passing through denser structures.

A bullet may lodge, or escape, after the most direct or the most devious route. It may lodge immediately beneath the integument, either at the point of entrance; or after passing through towards the opposite aspect; or after coursing on beneath the skin—its direction in this subcutaneous course being indicated by a discoloured mark, commonly called a "weal." It may lodge in bone, in any of the soft tissues, in the interior of cavities, in fact, in any part, however distant from its point of entrance, after the most direct or the most circuitous and lengthened route. It may escape, by an opening directly opposite to the aperture of entrance, after passing directly through tho part, or merely running round beneath the integument; or it may proceed further in the latter course, escaping near the aperture of entrance, by which it may indeed emerge, so that only one opening is made,—a circumstance which might lead to the belief that the shot had lodged. Under one other condition the same may occur. Thus, sometimes, when the ball, possessing slight impetus, strikes a part of the body covered by dress, it may, if this be thin and tough, force a portion of it before itself into the wound, and that without tearing it off, so forming an involution, or *cul de sac*, in the interior of which the ball lies, and from which it drops accidentally, or is brought away by traction on the remainder of the cloth. In this case, where the wound lies beneath clothing of unbroken continuity, it cannot of course be supposed that the ball has lodged, although there be but one aperture. A leaden bullet, impinging on a sharp edge of bone, may be divided, and a half pass on each side of the opposing bone, each portion emerging by a separate aperture; or one part may escape and the other be detained. The ball may force a portion of clothing into the wound, and both lodge together; or, itself passing by, may lodge further on, or escape.

Perhaps it is no bullet of lead or of iron which enters, but a fragment or splinter, dashed up by the striking of a shot in the neighbourhood, or by the bursting of a shell. Or it may be neither metal, stone, nor wood which enters, but merely wadding, as may occur, when the gun is fired at close quarters, and not loaded with any more solid projectiles: for, at short distances, wadding may penetrate many layers of dress, carrying portions along with it, inflicting a ragged wound, and, when deep enough, almost invariably lodging. A single deep and very uneven wound may also be produced by an aggregation of small shot, ere they have proceeded far enough from the gun to have become widely separated.

When there is more than mere contusion, the opening of entrance is of course always present, but that of exit is more inconstant. It may be wanting altogether, as when a bullet lodges; or wanting, at least as a separate orifice, when the bullet emerges at the same aperture by which it entered, either after crossing beneath the integument, completely around the limb, or when drawn out along with an untorn tubular invagination of the dress. The opening may be single, by which the whole bullet, or only half of it, when split after entrance, has escaped; or it may be double, when both portions of the bullet, split on a crest of bone, have emerged each by a separate wound of the integument.

But two bullets may have entered by the same wound, and only one of them have escaped; and though there may be one or more apertures of exit, yet these apertures may have been apertures of entrance to other balls which also have lodged.

The amount of injury varies, of course, according to the parts wounded. Owing to the uncertainty regarding the course of the ball, it is impossible, at first, to say what these parts are; and time alone can show what shall be the ultimate amount of destruction, after inflammation and sloughing to a greater or less extent have occurred. Large vessels may be wounded, while yet sometimes they marvellously escape division, as when a bullet passes between a large artery and its vein, lying together in close juxtaposition. In these cases, however, the vessels are generally so much bruised, as to slough or ulcerate during the coming inflammation, giving rise to secondary hemorrhage. Important nerves may narrowly escape, or be bruised and divided. Bone may be simply fractured, with or without wound of the integument; yet still not without much contusion, favouring the occurrence of necrosis: or, it may be extensively comminuted and splintered, or perforated, the aperture thus made being always, in the flat bones at least, considerably larger than the bullet; or, it may be in the resisting body that the ball lodges. Serous or synovial cavities, and mucous canals may be traversed, or merely entered, while the foreign body lodges. Vital or other important organs may be injured, but it by no means follows that death is immediate, in even extensive lesion of some of these parts.

Gun-shot wounds are very liable to be complicated in their progress by various affections. They are peculiarly apt to be followed by deep-seated inflammation, and purulent infiltration of cellular tissue. Necrosis is a very common result of exposure or bruising of bone.

The pain occasioned by a mere flesh-wound from fire-arms is usually not severe at first. There may be a momentary pang, but it is generally more a sense of numbness and loss of power that are experienced. When, however, bones are fractured, and large nerves lacerated, severe pain is at once produced. Hemorrhage may not be great when no large vessel is divided, but when such is the case, bleeding may be copious. It is really as abundant—though perhaps it may not appear externally for some time, as after most other kinds of wounds, except the smooth incision; and certainly much more so than after a simple laceration. The form of a gun-shot, as of a punctured wound, favours the easy suppression for a time of external hemorrhage, even when a large vessel, deep-seated, has been opened; but here, after a period, blood will break out unexpectedly, or it may be pouring forth internally to a fatal extent. Secondary hemorrhage, also, is much to be dreaded, particularly when extensive sloughing, or sloughing phagedæna, occurs—neither of which is very uncommon during unhealthy seasons, and in crowded military hospitals during time of war.

The shock varies much in degree. There seems every reason to believe that the mental part of it, at least, is generally more severe in gun-shot than in other wounds of equal extent. Owing to the extraordinary force and rapidity of the missiles, against which no guard can be raised, an injury thus inflicted is regarded with a greater degree of apprehension than others of a nature which can, to some extent, be foreseen and guarded against, and which, in a slighter degree, are more generally incurred. I refer to cuts, and stabs, those received in action being aggravated examples of what happens, on a much reduced scale indeed, but still very frequently, to all persons who employ sharp instruments of any sort. Some men certainly sustain very extensive gun-shot injury of the extremities without being much depressed; or are so only for a short time. But in others, undoubtedly brave, a comparatively slight wound of this nature is productive of the severest symptoms of shock. In this case, however, words of encouragement, together with the exhibition, if necessary, of diffusible stimuli, soon rouse the patient from this chiefly mental depression. But when the symptoms of shock continue long and severe, notwithstanding the employment of the restoratives just indicated, it may with reason be concluded, that there are ample grounds, of a physical character, for its long continuance; and that, owing to the lesion of some important organ, the wound is in reality of a much more serious character than was at first imagined.

In the treatment of gun-shot wounds, the first indication is, to promote the departure of collapse when this is present to a serious degree, by encouraging language, and, when necessary, the administration of diffusible, or even more permanent stimuli. The latter, however, should for obvious prospective reasons be, when possible, avoided. If the pain at this early period be excessive, anodyne fomentations are advisable.

When the shock has by these means worn off, the subsequent treatment is to be regulated by a consideration of the nature of the wound—of the part injured, and the extent and kind of lesion—of the present and previous sanatory condition of the patient—and of the means of treatment at command.

Thus, when a limb has been rudely carried away, leaving the remaining parts very much contused and ragged, conditions which would necessarily ensure the occurrence of extensive gangrene, great constitutional disturbance, an useless stump, and probably also hectic fever from profuse discharge, and tardy cicatrization;—when there is extensive contusion, amounting almost to disorganization of the soft tissues of a limb, either with or without fracture of bone;—when there is extensive bruising, laceration, or removal of the soft tissues, especially of the chief vessels and nerves;—when there is much comminution, or bad compound fracture of the shafts of bone, particularly of the femur;—when the joint-ends of bones are shattered, and large articulations laid open, such as the knee, ankle, or hip-joint—then, in all these cases, unless there be also some other and decided mortal injury, amputation is generally considered requisite, either actually to save life, or to protect the system from very great risk and suffering, which, if at last surmounted, could only result in affording a very bad natural stump, or in the preservation of a useless limb.

In military practice, primary amputation, performed during the few hours between the departure of collapse and the supervening of inflammation and symptomatic fever, has been found far more successful than a similar operation performed at a later period, after the system has suffered from inflammation, irritation, and, it may be, typhoid symptoms, extensive gangrene, and probably hectic fever. During the more violent stages of most of these complications, no operation could well be practised, but would require to be further delayed, until the system lapse into a more quiescent state. In campaigns also, it is, in order to save life, frequently necessary to amputate a limb at once, which, with the more ample conveniences for treatment enjoyed in civil practice, might possibly have been saved; but which, if not removed, would certainly be attended with fatal consequences, owing to the turmoil of the camp, the jolting of the march, the possible deficiency of suitable apparatus, and the crowded condition of military hospitals during war, where the numbers prevent any extraordinary attention from being paid to a single case.

It must be remembered that in the upper extremity, although bones may be badly fractured, or joints opened, with or without shattering of the articular extremities of the bones, yet a useful limb may be saved. In the former case, when there is merely a simple laceration, adhesion may possibly be attained; and in the latter, excision of the joint-ends is preferable to amputation of the limb. The last remark applies also to open fracture of the neck of the thigh-bone, accompanied with bruising, when neither the trochanter nor the pelvis has shared in the comminution.

These injuries, converted by amputation into clean incised wounds, to be healed by adhesion or granulation, being now kept out of view, other cases of a less immediately dangerous character come to be considered.

In addition to promoting departure of collapse, the principal indications are,—to arrest hemorrhage,—to remove foreign matter, whether balls, fragments of metal, clothing, stone, wood, or earth, as well as any portions of bone which have become so detached as to afford no chance of reuniting, but would, if left, become necrosed;—to limit by local and general means the coming inflammation, and its probable sequence, gangrene, which would entail loss of parts and serious constitutional disturbance;—to obviate the accidental complications;—to promote healing, and support the system under suppuration;—to remove the limb under certain circumstances by amputation, when extensive or extending gangrene occurs, or suppuration is excessive, and hectic fever otherwise intractable, this being called secondary amputation;—and to perform another and second amputation, when the stump obtained by the primary, or secondary operation has been destroyed, or much injured by further gangrene or sloughing phagedæna, with consequent protrusion and exfoliation of the bone.

The wounds inflicted by fire-arms, which are of an open, lacerated or contused character, being treated exactly as similar injuries produced in any other manner, the following observations are chiefly directed to those lesions most characteristic of the passage of a comparatively small body into or through the living structures, namely, those wounds which, in addition to contusion and laceration, have a punctured or tubular character.

The first indication, namely, to arrest hemorrhage, may be accomplished by cold, and slight pressure, when there is mere oozing. But whenever an important arterial trunk has been wounded, nothing but ligature of the vessel, above and below the point of lesion, can be trusted to. In order to reach the artery, and permit the application of ligatures, the wound may require to be dilated by incision, perhaps in a very free manner;—a practice which is also necessary under two other conditions, namely, when foreign matter has lodged and cannot be removed without enlargement of its track, or when matter forms and is not freely discharged. Pressure is usually inefficient to stay the bleeding, and could seldom be applied with the requisite nicety, or without resting injuriously on the neighbouring parts, some of which, as well as a portion of the artery itself, are pretty certain to slough. The second indication,—removal of foreign matter of whatever nature, may sometimes be effected by the finger or forceps without enlargement of the wound, sometimes by slight dilatation, and occasionally by a mere cutaneous incision, when the ball is felt resting beneath the integument. It is very important to remove all extraneous substances, when possible, without great meddling and cutting, because their presence aggravates the coming inflammation, and in this manner retards the cure. But when the foreign matter is deeply lodged among important parts, where dilatation could not be practised without danger, or when it is firmly lodged in or between bones, whence it could not be extracted without further crushing or fracture, it must be allowed to remain until suppuration has ensued. Then the part being relaxed, and the channel widened, it may in general be withdrawn with facility. From some situations, however, bullets cannot be even then removed without very extensive incision. It is sometimes difficult, if not impossible, to ascertain with certainty whether or not foreign matter is present. In some circumstances, indeed, as when it is known that there was only one discharge of a piece of fire-arms, loaded with a single bullet, then the number and situation of the apertures will afford pretty strong presumptive proof of the ball having lodged or escaped, while the part of the body injured, and its distance from the weapon, may indicate whether or not portions of clothing or wadding may also have entered. But, from former remarks, it is evident that in action, where numberless missiles are flying about in all directions, no such inference can be drawn from simple inspection of the wound. Accordingly, the part is placed in the same attitude in which it received the ball, as in this way the track of wound, through successive layers of structures, is made more directly continuous, and its exact direction may be more easily guessed. The finger or probe is now to be employed, gently, but with decision, so as to ascertain the presence of foreign matter. Probing is much better tolerated at this early period than on any subsequent occasion. On the extremities, this operation may be performed with some degree of freedom; but when the ball has pierced the parietes, and entered either of the three great cavities, no exploratory proceeding is justifiable. If it be felt imbedded in the substance of the walls, or immediately within them, it should of course be removed; but if not at once discovered, no further manipulation is proper. A contrary proceeding might, indeed, at the expense of much injury, satisfy curiosity, but would afford no opportunity of adopting any important alteration of treatment.

Smooth and rounded balls, when they cannot be removed at first, sometimes remain imbedded for a long series of years, enclosed in a cyst or capsule, seemingly of condensed cellular tissue, or in the dilatation or *cul de sac* of a long winding and narrow sinus, so as to be productive of little inconvenience or uneasiness, except during atmospheric changes, much exercise, or general ill-health. In general, they at last come slowly to the surface, when they may be removed, or if not, they create such an amount of discomfort that the patient is induced to submit to a deep operation for their removal. Rough and angular fragments of iron, or of detached bone, create greater mechanical irritation, lead to more active inflammation and suppuration, and require more speedy extrusion. The third indication,—to limit inflammation and its consequences, is effected locally by rest, elevation, and relaxation of the part; by careful adjustment; and by cold water-dressing, under the use of which, Mr. Guthrie has shown that the sloughing consequent on gun-shot wounds, is much less than under the old treatment by heat and poultice. The cold applications are continued for a considerable time, and when the inflammation has become very high, they are gradually changed for the tepid, and finally for the warm dressing, which, by its relaxing effects, affords more relief to the parts in their state of tension. Abstraction of blood from the neighbourhood by means of leeches or scarifying, is, in many instances, an important part of local treatment during the inflammatory stage. Generally, the same indication is fulfilled by the antiphlogistic regimen, comprising a moderate unstimulating diet, saline purgatives, and diaphoretics. Purging is, however, to be avoided in any wound as much as possible. When the injured part is disturbed by the motion attending alvine evacuations, venesection may even be necessary; but, as in all wounds which heal chiefly by granulation, depletive measures must be employed with caution.

In a very few instances, where the wound is small and clean, with no lodgment of foreign matter, and a very quiet constitution, it has healed under the above treatment, by adhesion, throughout its whole extent. But it much more generally happens, even when inflammation has been limited to moderate bounds, that a tubular slough is detached from the point of entrance, and a little way beyond it, at which places the contusion has been greatest.

When excessive vascular action ensues, the whole track of the wound may slough, and gangrene extend in any direction.

The remaining indications of treatment are to be fulfilled in accordance with the general principles which regulate practice in lacerated, contused, and punctured wounds. The conditions which require primary, secondary, and second amputation have already been considered. In the two latter cases, they are in no respect peculiar, or different from the circumstances which, in other injuries, are considered on sound principles to require similar treatment.

POISONED WOUNDS.

Poisoned wounds are those in which the introduction of noxious matter accompanies solution of continuity. The poisonous principle is absorbed by the wound, enters the general circulation, and is rapidly distributed through the body, producing its pernicious effects on the various organs and the vital functions, but manifesting itself in a peculiar degree on the nervous system. On it certain poisons act so rapidly as to have given rise to the suspicion of their having some more direct mode of communication with the cerebro-spinal axis; and this is supposed to be by the nerves of the part with which they have come in contact. The interval between the introduction of the virus, and the manifestation of its peculiar effects, differs in different poisons, and also according to the quantity introduced, and the proximity of the point of entrance to the brain. Some of the more virulent varieties have exhibited their effects in so short a time as the sixth part of a minute; but, generally, the interval is much longer: and some, such as the virus of hydrophobia, may remain in the system for weeks, or even months, before their characteristic results become apparent. During this period of incubation, as it has been termed, between the introduction of the poison and the manifestation of its effects, it is supposed to become increased in quantity by exciting certain morbid changes in the blood, which, when once commenced, go on producing that increase. This process is named zymosis, from its supposed analogy to that of fermentation in saccharine liquids, on the addition of the yeast-plant. Those poisons, which exhibit their effects very speedily, must, if they operate by a zymotic action, accomplish this process with extreme rapidity.

There are, applicable to all poisoned wounds, certain general principles of treatment, the local particulars of which are the most satisfactory in their results. The grand indication is, to prevent absorption of the virus, by immediate excision of the wounded part, by destroying it chemically with an escharotic, or by suction of the mouth, or by an exhausted cupping-glass—a ligature having been applied tightly round the part on the cardiac aspect of the lesion, and retained until either of the above operations has been performed, and until blood has flowed pretty freely from the wound. In some injuries, the gentlest of these means is amply sufficient to prevent bad consequences; but, in others, one or all of them may be found to fail. Subsequent local complications must be treated according to ordinary principles.

These injuries, if at all severe, are generally followed by a stage of depression, which may be so great that the patient rapidly sinks; and in nervous persons, very slight wounds, of a scarcely poisonous nature, are followed by a shock, chiefly of a mental character, produced by the fright more than by the actual injury. During this stage the usual restoratives, of a mental and physical nature, are to be employed. These comprise gentle reassurance, and stimuli when necessary, of which ammonia and brandy are those usually preferred. If the patient live, reaction ensues, violent perhaps, but very generally asthenic. In the slighter forms, sedatives and mild antiphlogistics are to be employed with caution, in order to moderate the excitement of the system generally, and of the local action, which, during this stage, is often very severe. At the same time, gentle purgatives and diaphoretics should be exhibited, with the view of promoting elimination from the system. In many instances, however, there is already such prostration of the vital powers, that even in this stage none of the lowering measures can be employed. In some cases the action is of a more specific character, and its treatment more uncertain; while in others, the patient, after surviving both the previous periods, and after having been much depressed in vital energy by the poison, is brought into great danger by extensive sloughing and diffuse suppuration—conditions demanding, in addition to suitable local treatment, generous support and the judicious employment of all advisable means for maintaining the general strength.

DISSECTION WOUNDS.

Dissection wounds are frequently received without bad consequences, but sometimes they give rise to serious and fatal results. They are chiefly dangerous when the health of the dissector is impaired from any cause, or when the virus is received from a body in which the cause of death has been puerperal disease, or acute inflammation of serous membranes.

In slight cases, where bad results occur, the wound inflames in a few hours, and a pustule forms, which, on bursting, discharges a thin, unhealthy matter, and is converted into an acute ulcer. In more severe cases, erythema, erysipelas, whitlow, or inflammation of the lymphatics of the arm may occur; or chronic abscess with induration, or acute abscess with purulent infiltration, may form in the axilla; and this last complication frequently extends down the corresponding side of the thorax. In very severe cases, the axillary symptoms, commencing with acute pain and rapid formation of abscess, may occur before much irritation about the wound is perceived. The constitutional symptoms vary in intensity. In slight cases the constitutional affection may be sthenic and trivial, but in more severe instances, the asthenic, irritative, or even typhoid type prevails. In the worst instances, the systemic disorder appears before the occurrence of any very distinct local signs of inflammation.

The treatment of the wound varies according to its form and the subject from which the virus has been introduced.

If the body be that of a person who has died of acute peritoneal or puerperal disease, it is advisable, after washing, to make a perfect excision of the wounded part; to allow oozing to go on for a short period; and if any time has been allowed to elapse between the infliction of the wound and the performance of excision, in addition to the above proceedings, to employ suction; and after oozing has ceased, to touch the part very freely with the nitrate of silver, with the view of effecting destruction of any virus that may be lurking in it. In any ordinary case, it will be considered sufficient to wash the part instantly, to suck it well, and if it be a mere puncture, and do not bleed, to enlarge the opening slightly with a clean pointed knife, so as to encourage the flow of blood, and thus favour the removal of any matter. The nitrate of silver is frequently employed as an escharotic after suction, without excision, and is probably useful by destroying or neutralizing the virus, if present, and by forming a crust of coagulated effusion, which prevents admission of noxious matter. I should never, in any case of poisoned wound, trust to an escharotic alone; and it ought to be remembered that, if the nitrate of silver be used gently, it acts merely as an astringent, and that it is only when it is used very energetically, that it has an escharotic effect. It is advisable for some time to preserve the part at rest, in an elevated position, and to enclose it for a few hours in a soft soothing poultice. The digestive organs should be cleared out, the diet attended to, and all sources of local and constitutional irritation avoided. If constitutional or local symptoms supervene, they should be treated according to the principles already mentioned.

MALIGNANT PUSTULE.

Butchers and others, who have to do with the bodies of the inferior animals, occasionally meet with wounds of a similar character, and requiring the same treatment as those to which the medical student in the anatomical rooms is liable. But there is one variety of wound thus obtained, which is somewhat peculiar in its consequences. The affection is characterized by the formation of a dark vesicle, rapidly followed by very painful inflammation and hardening of the dermis immediately below and around it. The vesicle bursts, the cellular tissue becomes involved, and sloughing phagedænic ulcer is produced. The constitutional disorder may at first be sthenic, but it very soon becomes typhoid, and as the local destruction extends, life is brought into the greatest danger. The constitutional and local treatment for malignant pustule is the same as that resorted to in the worst forms of sloughing phagedæna, attended with great constitutional depression.

WOUNDS INFLICTED BY THE BITE OF A DOG.

Wounds inflicted by the bite of a dog are always regarded with apprehension, because, although the animal seem healthy at the time, and may not become evidently rabid for several weeks after, yet a person, bitten during the stage of incubation in the animal, is liable to be attacked with the fatal disease, Hydrophobia. Many more persons, however, are bitten than are so attacked, even when the dog is manifestly affected. When the wound is inflicted through a portion of clothing, there seems to be less danger, probably owing to the teeth having been wiped clean in their passage through the dress. The virus contained in the saliva of the animal, whether dog, wolf, fox, cat, or badger,—for all these may become rabid,—must, as far as the integument is concerned, be applied to an abraded surface or wound, ere it can produce the disease. But several very striking cases, recorded by the late Mr. Youatt, seem to warrant the conclusion at which he arrived, namely, that mere contact with the mucous membranes may, without abrasion or breach of surface, communicate the disorder.

The local treatment of a bite from a dog varies according as it is believed that the animal is healthy or not. If there seems every reason to conclude that the animal is perfectly well, not being even in the stage of incubation, and that the bite, consequently, was merely inflicted after provocation, or in self-defence, then the part should be well washed, a cupping glass applied to withdraw any simply irritating matter, and the wound afterwards treated for granulation, like any other puncture or laceration. But if there be the slightest grounds for suspecting that the animal is rabid, or in the stage of incubation, instant and complete excision of the bitten parts is the only practice which can be trusted; and, till this is accomplished, a ligature should be bound tightly around the limb between the point of lesion and the heart, so as to prevent venous return and absorption. An exhausted cupping glass is then to be applied, in order to abstract any virus that may have penetrated more deeply, while at the same time it draws blood. The raw surface is finally to be treated with lunar caustic, which will arrest any persistent oozing, and, if possible, make security doubly sure, as regards the destruction of noxious matter. The nitrate of silver is sometimes employed alone, by persons of great experience, in preference to excision. Amputation even is requisite, if the part, such as a finger or hand, is so much lacerated and bruised that complete excision cannot well be effected. Though a period of several days may have elapsed after the bite, still, until the commencement of the local sensations which precede that of hydrophobic symptoms, the operation of excision or amputation should be performed. Subsequently, the tone of the general health is to be maintained, and mental anxiety as much as possible calmed.

Dr. Watson, in his admirable work on "The Principles and Practice of Physic," has so clearly stated what ought to be the proceedings of the surgeon regarding these wounds, that I cannot avoid transcribing his observations. "In the matter of cure, surgery, I fear, is as impotent as physic. Not so, however, in the matter of prevention: this is the most important part of the practice. The early and complete excision of the bitten part is the only measure in which we can put any confidence: and even here we are met with a source of fallacy. In the majority of cases, no hydrophobia would ensue, though nothing at all were done to the wound. How can we know, then, that the disease is ever prevented by its excision? No doubt many persons go through the pain of the operation needlessly. But in no given case can we be sure of this. They get at any rate relief from the most harassing suspense, with which they would probably have been tortured for months. And if a large number of bitten persons, who have suffered the wound to heal as it would, could be compared with an equal number who had had the bitten part cut out, hydrophobia would be found a frequent consequence of the bite in the first class,—a very rare consequence of it in the second."

Mr. Youatt, who trusted to caustic, and who had himself been bitten seven times, tells us that he had operated, with the caustic, on more than four hundred persons, all bitten by dogs, respecting the nature of whose disease there could be no question, and that he had not lost a case. One man died of fright, but not one of hydrophobia. Moreover, a surgeon of St. George's Hospital told him, that ten times that number had undergone the operation of excision there, after being bitten by dogs (which might not, however, have been all rabid), and that it was not known that any one had died. Mr. Youatt, I say, trusted to caustic; and the caustic he used was the nitrate of silver. But I advise you to trust to nothing but the knife, if the situation of the bite will allow you to employ it effectually. If the injury be so deep, or extensive, or so situated, that you cannot remove the whole surface of the wound, cut away what you can; then wash the wound thoroughly, and for some hours together, by means of a stream of warm water, which may be poured from a tea-kettle; place an exhausted cupping-glass from time to time over the exposed wound; and, finally, apply to every point of it a pencil of lunar caustic. If you cannot bring the solid caustic in contact with every part, you had better make use of some liquid escharotic—the nitric acid, for example. In my own case—and what I should choose for myself I should advise for another—if I had received a bite from a decidedly rabid animal upon my arm or leg, and if the bite was of such a kind that the whole wound could not be excised, my reason would teach me to desire, and I hope I should have fortitude to endure, amputation of the limb, above the place of the injury.

I say *early* excision is the only sure preventive; but let me repeat, that it will, in all suspicious cases, be advisable, if, for any reason, the operation have been omitted in the first instance, to cut out the wound, or the cicatrix, within the first two months, or at any time before the symptoms of recrudescence have appeared. One would do it, though with less hope, as soon as possible *after* they had appeared; but I do not expect to hear of excision then being successful in stopping the disease. Dr. Bright has recorded a case in which the arm was amputated upon the supervention of tingling and other symptoms in the hand, the patient having been bitten some time before in it; but the amputation did not save him.

THE STINGS OF INSECTS.

The stings of insects are rarely dangerous in this country, unless when very numerous, or inflicted on delicate parts, or on persons of an irritable constitution. If the sting be discovered by aid of a lens, it should be withdrawn by the point of a needle or fine forceps. Then, if it be a single puncture, mere suction for a considerable time will afford perfect relief; or the minute wound may be supplied with a drop of liquor potassæ, which is supposed to neutralize or destroy the irritating matter. But this remedy must be applied to the exact spot alone, as, when undiluted, it exercises a powerful solvent effect upon the skin. In some cases, touching the part with ammonia gives relief. Cold is then kept continuously applied by pure water or a saturnine lotion. When the stings are numerous, or the individual nervous, considerable depression may ensue, from the actual effects of the injury in the one case, or from mere fright in the other. Restoratives and stimuli may therefore be necessary; and when reaction occurs, attended by nervous excitement and irritability, sedatives and mild antiphlogistics are indicated. When an insect gains entrance to the nostril, mouth, or fauces, its sting is particularly distressing, and, in the last-named case, even dangerous, owing to the great and rapid tumefaction of the mucous membrane, and consequent interference with respiration, demanding instant relief by local scarification, followed by fomentations, and counter-irritation externally.

EQUINIA.

Equinia—a disease so named because animals of the equine genus, as the horse, ass, and mule, are subject to it—is sometimes transmitted to man by inoculation, or contact, and sometimes also, it is said, by infection. In the former case, the local consequences, up to a certain stage, are the same as in the more severe forms of dissection wounds. In both, there is fever of an asthenic type. The disease is afterwards characterized by severe pains in the joints and limbs, followed by hard circumscribed swellings beneath the integument of these parts, which then ulcerates or sloughs; by a sanious purulent discharge from the nostrils, but which, however, is not uniformly present; by the formation of numerous characteristic pustules, which generally become gangrenous; by a very low typhoid fever; and by speedy death, which usually occurs about the end of the first fortnight. The pustular eruption is considered most characteristic of this disease, which is commonly called "Glanders," when this symptom is present along with the affection of the nasal passages; and "Farcy," when these peculiarities are absent.

Hitherto the disease has been almost uniformly fatal, and the treatment adopted is merely palliative. The indications are, to support the system, and to alleviate local symptoms by fomentations, and deodorizing lotions. Of the former, a solution of creosote; and of the latter, the chlorides dissolved in water are the most efficient.

THE BITES OF SERPENTS.

The bites of serpents lead to results varying according to the species which inflicts them. The common viper is the most dangerous that is found in this country, but its bite is very seldom fatal. The effects are often distressing, but are scarcely dangerous, except in children, and in delicate persons of great susceptibility. The local irritation is repressed by the continuous application of cold, or subsequently soothed by heat and moisture, if it proceed to actual inflammation. In this case, moderate antiphlogistics may be required. Any other consequences, similar to those which result from dissection wounds, are treated on similar principles.

The number of poisonous serpents in different parts of the world is very considerable; but the most noxious on account of their venomous properties, are the Rattlesnake in America, and the Cobra di capello in India. All the different species of rattlesnakes are provided with two small sacs, each of which contains a minute quantity of poison, and communicates, by means of a short excretory duct, with the canal in the fang on each side of the upper jaw. It is inclosed in a bony framework, situated externally to the upper jaw, and is under the control of appropriate muscles, the action of which aids materially in expelling its contents. The fangs, situated just at the verge of the mouth, are very long, sharp, and crooked, like the claws of a cat, and are naturally retracted, and concealed in a fold of integument; but, when the animal is irritated, are capable of being instantly raised, and darted forwards with great force into the skin, followed by an emission of poison. The snake, then, does not bite, but strikes, making a punctured wound. The poison of the rattlesnake is slightly yellowish, thin, and semi-transparent, resembling clear honey, its quantity not exceeding three or four drops. It is peculiarly acrid and deadly in hot weather, and during the procreating season. In winter and early spring the reptile is in a torpid condition, and the poison is then not only diminished in quantity, but unusually thick, and almost destitute of virulence. The deleterious effects of the poison seem to be much weakened by a rapid succession of bites. The experiments of Captain Hall and of the late Professor Barton place this subject in a clear light. Of three dogs bitten in succession by a rattlesnake, four feet long, the first died in less than fifteen seconds, the second in two hours, and the third in three hours. Of three fowls, bitten on three successive days, the first perished in a few hours, the second lived for some time, and the third finally recovered, although not without considerable suffering. Instances occasionally occur in the human subject of almost instantaneous death from the bite of the rattlesnake; at other times the case proceeds more slowly, the patient not dying under several hours. Dr. Wainwright, of New York, lost his life in less than six hours from the time he was wounded. The animal, an uncommonly large one, had lain in a torpid state for some time, when, unexpectedly becoming warmed, he raised himself and struck his victim furiously on the last phalanx of the middle finger of the left hand. Although the wound was immediately sucked, and soon afterwards excised and cauterized, a ligature also being firmly tied round the wrist, the hand soon became enormously swollen, the tumefaction rapidly extending up the limb nearly as far as the axilla, and the surface, in the greater part of its extent, exhibiting a mottled bluish and greenish-yellow hue. The pulse soon became very feeble; in four hours the patient was in a state of stupor, and died soon after in a completely comatose condition. When death is almost instantaneous, the probability is, that the poison is injected directly into the blood, the fang having penetrated some tolerably large vessel. Under such circumstances, the blood is thin and black, and does not coagulate when exposed to the atmosphere.

The poison of the cobra di capello is of a semi-transparent and yellowish appearance, somewhat like olive oil, and its effects are very similar to those of the rattlesnake in America. The bite of the cobra di capello in India is often followed by extremely rapid dissolution. I have just received a letter from a member of my own family in India giving an account of the death of one of her servants, in which case the fatal event took place in ten minutes after the bite of the cobra di capello. Lately a showman, bitten by a rattlesnake in one of the menageries in Paris, died in nine hours. A showman bitten in London by a rattlesnake died in St. George's Hospital on the 18th day, with sloughing of the limb and large abscesses in the axilla. A remarkable case occurred lately in London of death from the bite of the cobra di capello. A keeper at the Zoological Gardens was bitten in the bridge of the nose, the poison-fang having apparently penetrated the angular vein. He was brought to University College Hospital in half an hour, in a dying state, and death took place in little more than an hour from the period of the infliction of the bite. He was unable to speak, swallow, or support himself when brought to the hospital; the heart's action was feeble, the pupils were dilated, the face was livid, and he was scarcely conscious. The lungs were found immensely congested, and so, also, were the solid abdominal viscera and the veins and sinuses of the brain. The right cavities of the heart were loaded with dark blood, the left were empty, and, in short, the post-mortem appearances in this case were those strikingly denoting death by asphyxia. The opinion formed was, that death resulted in this case from the poison paralyzing the medulla oblongata and the portions of the nervous sytem that preside over respiration, and also from the disorganization of the blood.

The poisons of these animals appear to cause death in two ways:—when very strong, by direct depressing influence, like some of the most powerful narcotic poisons; when less powerful, by diffuse inflammation of cellular tissue, abscesses, and gangrene. In the first-mentioned class of cases, the principal symptoms are extreme depression and sinking, a feeble, intermittent, flickering pulse, coldness of extremities, dilated pupils, speedy insensibility, stupor, and death. In the second class, the symptoms are of the most alarming asthenic character from the moment of the infliction of the bite, and if the patient survive sufficiently long, they are those which accompany the worst forms of diffuse inflammation—diffuse suppuration and gangrene. The local treatment consists in fulfilling two indications. The first, to prevent the absorption of the poison by tying a ligature tightly round the limb, by immediate excision of the part, followed by the application of the cupping-glasses, and, when cupping-glasses cannot be instantly obtained, by suction with the mouth, followed by the free cauterization of the part by the speedy and energetic application of a red-hot iron. Suction by the mouth is safe, provided there be no breach of surface of the mucous membrane, it having been shown that the virus does not act except on a wound or sore. The local treatment for diffuse suppuration and sloughing must be conducted according to ordinary principles.

The constitutional treatment consists in combating depression and sinking by the use of brandy, wine, ammonia, and other restoratives, and in the event of drowsiness coming on, in rousing the patient, and maintaining him, if possible, in a state of consciousness, resorting to artificial respiration with galvanism, if the necessity for such proceeding be indicated. Ammonia and arsenic are favourite remedies, the former being useful probably as a stimulant, the latter being believed by some to possess some virtue as an antidote to the virus, and perhaps to have some power of elimination. A remarkable circumstance is the large quantity of arsenic that has been given in such cases with impunity, its use being continued until free purging is induced. One grain of the arsenious acid, or two drachms of the liquor arsenicalis given every three hours are the doses that are said to have been so given. In the Island of St. Lucia the practice is, to give two drachms of Fowler's solution every three hours, to neutralize the poison of a most venomous serpent, the ter-de-lance; and the medicine is administered until free vomiting and purging are induced. The Tanjore pill, considered in India a specific, owes its efficacy to the arsenic it contains; and the eau de luce, much used in some tropical countries, owes its reputation to the ammonia which it contains. In America some medical men of eminence have confidence in the efficacy of Professor Bibron's antidote for the bite of the rattlesnake. Professor Bribon had such confidence in the antidote that he allowed a rattlesnake to bite him on the lip and cheek, and took the medicine and had no symptoms of injury from the bites. Dr. Hammond and Mr. Louis de Vesey have both used it with perfect success, and five cases successfully treated by this method are reported by American physicians. It consists of five drachms of bromine, two grains of the bichloride of mercury, and four grains of the iodide of potassium; the dose being ten drops, to be repeated if necessary in twenty minutes.

TETANUS.

There is a class of nervous diseases in which the function of voluntary motion is lost or diminished, comprehending the various forms of paralysis, and another in which that function is perverted—irregular and unnatural contraction being the main and leading feature. Two of the most appalling and fatal maladies to which man is liable, tetanus and hydrophobia, constitute frightful examples of the last-mentioned class. Such perversions may consist of long-continued and most painful contraction, followed by relaxation taking place slowly, which relaxation after a time is succeeded by contraction; or the contraction and relaxation may be rapid, forcible, in very quick succession—contraction and relaxation being both equally sudden and forcible: the former is called tonic spasm or spastic rigidity, being well exemplified in tetanus—the latter called clonic spasm illustrated in convulsive diseases, of which one of the most awful examples is witnessed in hydrophobia. In these spasmodic diseases, although the unnatural conditions of the muscles constitute essential characteristics, they consist essentially in an excited state of the spinal cord and medulla oblongata, in fact, of the whole true spinal system.

Tetanus, derived from τείνω, to stretch, is characterized by long-continued, violent, involuntary, true spasmodic rigidity of the voluntary muscles—in short, of cramp or tonic spasm which may affect the muscles of a part or of almost the whole of the body.

Varieties and Causes.—There are several varieties of this disease; and the term tetanus in the ordinary use of the word denotes the disease in general, including all the varieties; although in the strict acceptation, the term denotes involvement of all classes of muscles, without the preponderance of any, so that the body is rendered rigid and straight. It is thus used as a generic term, comprehending all the varieties, and also to distinguish one form of tetanus from all the others. When the muscles of the neck, jaw, throat, and face alone are involved, this form of the complaint is called trismus, or lock-jaw. When the affection of the muscles of the back predominates, the posterior muscles bending the body backwards like a bow, until, in extreme cases, the occiput and heels are the points of support, this variety is termed opisthotonos. When the muscles in front are chiefly affected, bending the body forward until the head and knees meet, the patient being rolled together like a ball, a rare form of the disease is constituted, called emprosthotonos. When the body is bent to one side, the case is called one of pleurosthotonos, or of tetanus lateralis. Lastly, opisthotonos and emprosthotonos have been seen to alternate with each other; but this is extremely rare. In the order of frequency, the varieties are trismus—tetanus being the term to denote the variety in which the body is rigid and straight—opisthotonos, emprosthotonos, pleurosthotonos, and the form in which opisthotonos and emprosthotonos alternate in the same patient. I have never seen an example of this variety or of pleurosthotonos. Tetanus, whatever be the form, may be either acute or chronic: the former being unfortunately the more common, the more fatal, and, indeed, seldom admitting of cure, having a tendency to involve the whole frame—having, in some instances, proved fatal in a few hours, but usually after the second and before the fifth day, and not unfrequently running on to the eighth or tenth day:—the latter having more a tendency to be partial, being less severe, and much more amenable to treatment, so much so that in very chronic cases there is good hope of recovery. It may be stated generally, that the more acute the disease the greater is the danger of a fatal result. Tetanus may be either traumatic or idiopathic:—the former a consequence of some wound or injury that implicates or irritates some nerve, the latter arising from some other irritation of the nervous system, as exposure to wet and cold. The presence of worms in the intestinal canal, and uterine irritation after abortion have been known to be exciting causes of idiopathic tetanus; but such examples are extremely rare, and, with very few exceptions indeed, tetanus may always be traced to bodily injury of some kind, or to exposure to cold, or some sudden alterations of temperature. In unhealthy tropical climates, examples of tetanus caused by atmospheric vicissitude are frequently met with. In some instances bodily injury and exposure to cold and wet co-operate to produce the disease. Striking confirmations of the co-operation of injury and cold in producing tetanus occurred after the battles of Dresden and Bautzen. The wounded in the battle of Dresden, when the weather was cold and wet after an unusually hot season, were decimated by this disease; and after the battle of Bautzen, where the wounded were left on the field exposed to cold and rain during the night, Larrey found more than one hundred affected with tetanus in the morning after the battle.

The kind and situation of the wound have unquestionably an influence in producing the disease. It most frequently follows punctured and lacerated wounds, especially in dense textures well supplied with nerves. Wounds of the above classes in the hands and feet, and more especially in the fingers and the ball of the thumb and of the great toe, are apt to be followed by tetanus. Such wounds being so frequent in these situations where the supply of nerves is abundant, it is less surprising that they should be the exciting causes of so many examples of tetanus : but as far as wounds are concerned, the cause of tetanus is not confined to wounds of the above classes, or to wounds in any particular situation ; for tetanus has been known to follow simple incised wounds in various situations, as in amputations, ligature of arteries, removal of the breast, and other operations. A confirmation of this statement is furnished by Sir James McGregor, who stated that in the Peninsular War the complaint supervened in every description and in every shape of wounds, from the slightest to the most formidable ; the healthy and the sloughing ; the incised and the lacerated ; the most simple and the most complicated. But bodily injury of any kind, without solution of continuity in some cases, and very slight wounds in others, has given rise to this complaint : thus, a stroke of a whip, as mentioned by Dr. Reid ; a child being suddenly thrown upon its back by another in playing ; the cutting of a corn ; a bite on the finger by a tame sparrow ; a blow with a stick ; fracture of a bone ; the sticking of fish bone in the fauces ; treading upon a nail or a splinter ; a burn of the hand, of which I have seen two examples ; the extraction of a tooth ; and the operation of cupping, have led to the occurrence of this formidable malady : and it may, therefore, be stated that it is liable to follow injury of every kind, extent, and degree, in any situation, from the slightest bruise, cut, and injury, to the most severe accident and formidable operation.

Period of Accession.—After the infliction of the injury, there is no fixed period for the commencement of tetanic symptoms. Larrey says that, during Napoleon's campaign in Egypt, the disease rarely appeared before the fifth or after the fifteenth day ; the surgeons of the Peninsular War, who had hundreds of cases under their observation, never found it commence after the twenty-second day ; and the testimony of most observers is, that its occurrence is in general between the fourth and the fourteenth day after the infliction of the injury, and that after three weeks have elapsed without the occurrence of symptoms, the patient may be considered as safe. Striking examples, however, are recorded of exceptions to this general rule. Dr. Robinson relates the case of a negro, who, while he himself was at table, cut his thumb with a fractured china plate, and died of tetanus in a quarter of an hour. Sir Gilbert Blane relates a case in which the commencement of symptoms was delayed for a month; and a very few cases are recorded in which a longer period intervened between the infliction of the injury and the invasion of tetanus. Idiopathic tetanus, or that caused by cold, differs remarkably from traumatic, in regard to the period of invasion. Although this variety of the disease is more chronic in character and more frequently recovered from than the traumatic, it takes place at a much earlier period after exposure to the exciting cause, generally in a few hours, and in many instances where exposure has taken place during the night, the disease has commenced in the morning.

Symptoms.—In the great majority of cases the invasion of the disease is preceded by general uneasiness, and a feeling of depression, or apprehension of impending danger. The muscles that in general are first affected are those of the temples, jaws, neck, and throat; and the last of all, those of the tongue and of the fingers and hands; a remarkable circumstance being, that in many cases the muscles of the hands and fingers escape altogether. The patient first feels that he is unable to open the mouth widely, or to turn his head with the usual facility. As the affection advances, the jaws cannot be opened sufficiently to receive food or drink; and, ere long, close entirely, sometimes gradually, sometimes with a snap, constituting the condition which has given the popular name of lock-jaw. The muscles of the temples, jaws, and neck feel stiff and rigid, the features become fixed and convulsed, the countenance has an expression of pain, and the angles of the mouth are drawn down, constituting the appearance called "risus sardonicus." Soon after the appearance of these symptoms, the muscles concerned in swallowing become affected; and this is speedily followed by a most distressing pain in the region of the diaphragm, proceeding, no doubt, from spasm of that muscle; and as the disease advances, when spasms in other parts happen to present a jerking character, the breathing is attended with a loud sob, or catch, no doubt owing to the spasm of the diaphragm being sudden, instead of gradual. In the progress of the disease, the powerful muscles of the trunk and of the extremities become affected with violent spasm, or cramp, and the patient is thrown into one or other of the various attitudes formerly described, when speaking of the varieties, according to the action of the muscles most violently affected with spasm. When the disease has fairly set in, there has been found in a few instances perfect remission of the spasm between the paroxysms: but that is far from usual, as the muscles generally remain for a short interval in a state of contraction, and feel hard to the touch; and this state is succeeded by violent exacerbation of the spasm, giving rise to the most excruciating pain, when the muscles again return to the state of minor contraction which existed prior to the exacerbation. The exacerbations in some instances come on with jerking contraction, so that the attitude assumed during the exacerbation becomes fully demonstrated in a sudden manner; and, in other cases, the change from the minor grade of spasm to the more severe is more gradual. The bowels are constipated, the stools in general are offensive, the pulse and respiration are quickened, and during the paroxysms there is often heat and perspiration from the violence of the pain: but the disease is unattended by pyrexia, and the intellectual faculties remain undisturbed even up to the fatal termination, the period of the occurrence of which seems to depend on the frequency and the severity of the spasms. It has fallen to my lot to see a good many deaths from tetanus; and, of the two forms of it, that by asthenia and that by apnœa, which are said by most authorities to be conjoined, the death, although of a varied character, has usually seemed to me to partake more of the character of asthenia than of apnœa, the failure of the heart's action being brought about by the excruciating pain, and, no doubt, accelerated by the inability of the patient to take food; the apnœa, on the other hand, being caused by the motionless condition of the thorax, produced by the spasm of the muscles of the trunk. Sometimes the patient dies suddenly during a paroxysm, when death is believed to be brought about by the spasms affecting the muscles of respiration, and perhaps also those of the glottis.

Post-mortem Appearances.—The only morbid appearance that I believe is constantly found in the bodies of those who have died of traumatic tetanus is, an inflamed condition of the nerve implicated and leading from the wound. I have been much struck with the extent of this condition in several post-mortem examinations I have made in our hospital and in private practice. In a case in which the internal popliteal nerve was half divided across by a small splinter of a stone sent into the popliteal space by the unexpected explosion of a piece of rock, in a quarry in this neighbourhood, tetanus came on, and the poor fellow died with his body bent like a bow, the points of support being the occiput and the heels. I was particularly struck with the extent of this condition, the nerve having been swelled so as to be thicker than the little finger. In a case in which the disease was caused by a person treading upon a nail, and where the internal plantar nerve was wounded, this condition was met with; and I also saw it to a great extent in four cases of death from tetanus brought on by injury of the radial nerve, two of the cases being lacerated wounds in the lower part of the fore-arm and outer part of the hand, and the other two, cases of deep burns in the same regions. In all these cases the radial nerve presented signs of intense inflammation, to above the middle of the fore-arm. On this interesting subject Rokitansky says:—"Froriep has ascertained that, besides the inflammation which is seen in the nerve at the spot which has been injured, a rosy reddening is produced at irregular intervals in its course by the injection of its neurilemma, but it is unaccompanied by any distinguishable products. The reddening is confined mostly to the surface of the nerve, though it sometimes dips a little way between the fasciculi. If a plantar nerve, for instance, has been injured, it is repeated three, four, five, or more times, in the course of the tibial and sciatic nerves, up to the sacral plexus; but neither where these nerves enter the medulla, nor in the cord itself, is any similar appearance to be found."

Slight congestion of the brain and spinal cord, and some slightly sanguinolent-looking effusion in the subarachnoid space and in the ventricles, constitute the only other appearances; and, as they are no doubt the effects of the violent spasms on the circulation, they leave the awful phenomena of this disease quite unexplained. The view taken of this most formidable disease is, that it consists essentially of some excited or irritated state of the medulla oblongata and spinal cord, brought on by irritation of a portion of the peripheral nervous system; which irritation is propagated to the medulla oblongata and spinal cord, becomes persistent, and induces reflex muscular movements in various parts of the body. Irritation is set up somewhere in the course of some incident nerves, by these nerves an influence is conveyed to the spinal axis, in which some change takes place, whereby an influence is reflected to muscles through motor nerves. It is therefore viewed as essentially a disorder of the excito-motory apparatus.

Treatment.—For the purpose of prevention, all wounds, and especially those of a nature or in a situation prone to produce tetanus, should be treated in a way to get rid of all local irritation as speedily as possible. When the disease has occurred, the treatment is both local and general. The object to be accomplished by local treatment is, the removal of all local irritation which may be capable of inducing the tetanic state.

It by no means follows, that the local irritation in the course of some incident nerves being removed, the centric nervous disturbance will cease; but it is reasonable to believe that the chance of the subsidence of the latter would be increased by the former being no longer in operation. In addition to the adoption of the most soothing system of local treatment and the removal of inflammation, tension, foreign bodies, and every form of local irritation from the wound, the division of the trunk of the implicated nerve on the cardiac side, if one nerve only has been punctured or lacerated, and if the branches of more than one nerve are believed to be implicated, sufficient incision to cut off all nervous communication should be instantly resorted to. Some cases have terminated favourably when this proceeding was adopted, and it being safe and not calculated, like amputation of an important part, to cause any shock or depression, it is surely advisable to give the patient the chance of benefit from it. On amputation in tetanus an excellent author writes:—"Dr. Elliotson says he has searched scores of books, and found only one case in which the limb and the disease were lopped away together." Mr. Blizard Curling, however, in his "Essay on Tetanus," refers to seven instances of recovery after the injured part had been amputated. Yet he states, "that it is almost impossible to ascertain with certainty how far the amputation, in these cases, was of service." I believe no surgeon at the present time would venture on the amputation of a leg or an arm on the approach of tetanus, or on any amputation beyond that of lacerated toes or fingers, or of some small part so injured as to be useless to its possessor in the event of recovery from tetanus. The constitutional treatment should have chiefly for its object the removal of sources of irritation and the support of the patient's strength. Exhaustion from pure muscular movement, and the want of food and rest, being the chief causes of death, the necessity of trying to support the powers of life until the disease wears itself out must be manifest. As a loaded state of the bowels is calculated to increase the irritability of the nervous system, and as more excitement and irritation of any kind calculated to produce an impression on the surface of the body or on the organs of sense are observed to increase the spasms, it is advisable to clear out the bowels in the first instance, and to keep the patient by himself in a cool, dark, quiet, airy apartment, with a screen or muslin curtains, as recommended by Dr. Marshall Hall, drawn around his bed, to caution him against speaking, and to avoid every unnecessary movement, and to enjoin the guarding against all unnecessary disturbance or annoyance in the administration of medicine or of food. Exposure of the body to a draught is of itself sufficient to bring on an attack of tetanus in a susceptible person; and as after an attack is established, such an occurrence aggravates the spasms, the suggestion of Dr. Marshall Hall is important. Nourishment and wine should be given freely by the mouth as long as possible; when that can no longer be done, they should be given by a small tube passed through the nose, a proceeding by which I have often administered nourishment and wine, with little annoyance to the patient; and when inconvenience attends this mode, by means of enemata. For the purpose of diminishing spinal irritation, the late Dr. Todd recommended the application of ice along the whole length of the spine. The constant extensive use of this application is likely to prove over-sedative; but its application to a limited extent to the back of the neck and upper part of the spine appears to be useful. I believe the above-mentioned treatment is as good as any that can be instituted; but I have never seen a case of acute traumatic tetanus recover under any treatment in the practice of other surgeons or in my own. All the recoveries I have seen have been in cases of idiopathic tetanus more or less of a chronic character.

It cannot be expected that, in a work of this sort, I should be able to give even an outline of the many remedies that have been suggested for the cure of this disease; and I must finish this subject, by simply stating, that I have had no means of seeing the effects of bleeding, so much practised by some French and other authorities, of tobacco, counter-irritation, cold bath, aconite, belladonna, mercury pushed to ptyalism; or of the wourali poison; and, on principle, I would abstain from their use, as they do not seem calculated to fulfil the rational indications of treatment.

Indian hemp, employed with favourable results by Dr. O'Shaughnessy and others at Calcutta, and in three cases by Professor Miller in this country, has not appeared to do any good in the cases in which I have seen it employed. Recovery has not taken place in any instance in which I have seen chloroform employed: and I confess I have no faith in its doing any good beyond a very temporary subjugation of the spasms; and the great exhaustion that succeeded its use n every case has given me a prejudice against its employment in his disease, although no one can esteem it a greater blessing than I do to those undergoing surgical operations. Opium has appeared to ne of unquestionable service, especially in cases where there was great exhaustion, or where the disease was attended with a painful wound; and the recoveries I have seen from tetanus have all been cases, where the treatment formerly directed was instituted along with the use of this remedy, alone or conjoined with calomel. Notwithstanding he physiological principles on which Budd and others have questioned he propriety of its use, all I have seen impresses me strongly in its avour in this dreadful disease. It should be administered in large nd repeated doses, with a view to immediate and decided impression, nd in a liquid form—either laudanum or a solution of the muriate or f the acetate of morphia. Opium in substance is objectionable, as, n account of the sluggish state of the stomach, it has been found to emain undissolved. The remark of Abernethy on this subject was, "that he had found enough undissolved pills of opium in the tomach after death to poison a dozen healthy persons." It has lately een proposed to administer opium in tetanus in the form of fume, *à la Chinois*; but I have not as yet seen it so administered.

CHAPTER VII.

TUMOURS.

A CORRECT classification of tumours has always been acknowledged to be extremely difficult. In a histological point of view, they have been arranged into two grand divisions—namely, first, homologous, homœomorphous, non-malignant, or benign; second, heterologous, heteromorphous, or malignant.

The first class comprehends those whose structure histologically agrees with that of some normal tissue. To this class belong, among others, fatty, fibrous, cartilaginous, and osseous tumours. Homologous tumours resemble normal textures in their histological composition, in their origin, in their mode of growth, and in forming persistent constituents; they do not depend on constitutional cachexy, are not apt to return, and have no tendency to convert surrounding textures into structures resembling their own; hence they are said to be non-malignant, or benign. When tumours belonging to this class prove injurious, it is principally owing to their size, or to pressure on surrounding parts; and when they become the subjects of inflammation, it is owing to exposure to mechanical injury, or to irritation caused by pressure, or to some other external cause, and not to their own nature, or histological elements.

The second class comprehends those whose elements may be considered histologically to differ from those of the normal body, and which have a tendency to extend to surrounding parts, and change them into structures resembling their own; and from the very nature of their histological elements, have a tendency to proceed to softening. Carcinomatous and medullary tumours may be mentioned as examples of this class. They have also a tendency to return after extirpation, and are connected with constitutional cachexy.

In regard to the malignancy or non-malignancy of tumours, Vogel makes the following remarks:—"It has not always been clear wherein consisted the malignant, or non-malignant, character of a tumour. It has been generally agreed, that the non-malignity of a tumour consisted in the circumstance that it would not be reproduced after extirpation; those which after extirpation were again produced being held to be malignant. This view I regard as incorrect; tumours which are manifestly non-malignant, as, for instance, encysted tumours, may again reappear through the same originating force which first produced their development; whilst tumours notoriously malignant may never return after extirpation, or may even vanish of themselves, provided that the disposition to their formation no longer exists, as has been undoubtedly shown in relation to the pulmonary tubercle. The malignity, which forms the grand division between these two classes of tumours, is connected with the very nature of the tumour itself, and depends on its histological elements."

Although objections have been urged against this division of tumours, inasmuch as some—tubercular tumour, for example—may be as justly annexed to the one class as to the other, having some characters common to each, it has notwithstanding been considered by some of our best authorities to be more practically useful, and more conformable to nature than any other classification as yet brought forward.

I. HOMOLOGOUS, HOMŒOMORPHOUS, NON-MALIGNANT, OR BENIGN TUMOURS.

1. SIMPLE SARCOMA.

Under this appellation have been comprehended simple enlargements, or hypertrophies, of organs; as, for example, simple or chronic enlargement of the mammary gland, testicle, or thyroid gland,—conditions in which the natural elements of the normal structure, though in an increased and altered condition, may be recognised by the aid of the microscope. But the term simple sarcoma has also been applied to tumours independent of special organs, which, it is believed, are formed by the change of exudation into cells and fibre-cells. These ultimately assume the appearance of areolar tissue; vessels are developed, and the structure becomes incorporated with the tissue from which the exudation had taken place.

2. FIBROUS TUMOUR.

Seats.—Fibrous tumours occur in many different situations, but most frequently in the neck, in the neighbourhood of the parotid gland, in the uterus, in the neighbourhood of the mammary gland, in the skin, forming warts, in the nostril, constituting fibrous polypus, and connected with periosteum in other parts of the body. The uterus, nerves, subcutaneous cellular tissue, bones and periosteum about the jaws, are their most common seats.

Professor Paget, in his exceedingly interesting lectures on tumours, remarks regarding fibrous tumours:—"The usual distinction must be drawn between the tumours and the outgrowths of the same structure. The uterus presents examples of both. The fibrous uterine polypi, more properly so called, are continuous outgrowths of, and from, the substance of the uterus; the mucous membrane and the muscular and fibrous tissues of the uterus, growing in variety of proportions into its cavity and that of the vagina. The fibrous tumours, as distinguished from these, are discontinuous growths of similar tissue, in or near, but not of the substance of the uterus. The distinction is often difficult to make during life; for the pendulous, polypoid, and narrow-stemmed outgrowth may be imitated in all its external characters by a tumour growing near the surface of the uterus, and projecting into its cavity, with a gradually thinning investment of its muscular and mucous tissue."

Characters.—Fibrous tumour is slow in its growth; is unattended with pain or tenderness, unless accidentally inflamed; is extremely hard, globular in form, with its surface smooth or lobulated; is moveable, and is enclosed in a cyst of condensed cellular tissue, by which it is separated from the surrounding parts. When situated in the neighbourhood of a gland, such as the parotid or mammary, it causes absorption; and from this circumstance comes apparently to occupy the situation of the gland; so that an incautious observer might be led to mistake the tumour for a disease of the gland. The tumour causes inconvenience, principally by its size and by pressing on surrounding parts, and, like all non-malignant tumours analogous to the normal elements of the body, by becoming the subject of inflammation, ulceration, and softening. These changes are produced by the influence of causes which are not inherent in its nature, but exoteric and accidental.

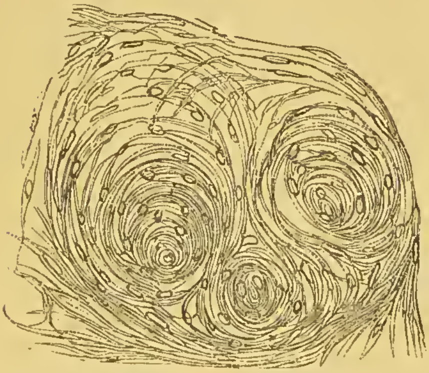
Fibrous tumours present considerable varieties in the histological arrangement of their fibres. In some cases the fibres resemble those of ligament, as in what is called the desmoid tumour; in some of a very firm elastic character, the fibres are compressed into a very solid mass, and are with great difficulty separated, as in what is termed the fibroid tumour; in some, the fibres are so compressed and firm, and the tumour is so uniform, having a homogeneous and white appearance, that this variety has been named *chondroid* tumour, from its resemblance in appearance to cartilage, although histologically its structure is quite different; in some, the fibres are arranged in concentric circles, presenting a most beautiful appearance when examined by the microscope; and in some, they run irregularly in every direction. By the characters mentioned above, and by the absence of the usual signs of carcinoma, it is generally easy to distinguish this form of tumour from cancer; but when it is not so, the diagnosis can only be established by the use of the exploring needle and the microscope;

Desmoid

Fibroid

Chondroid

Fig. 38.



Section of a desmoid fibrous tumour of the uterus, after the addition of acetic acid.—From BENNETT.

the presence of fibres and the absence of cancer cells will reveal the nature of the tumour. In some large fibrous tumours, especially in the uterus, calcareous salts are sometimes deposited; and these unorganized concretions have by some been incorrectly regarded as formations of bone. Another change met with in this class of tumours is, the formation of cysts. This has been thought to be due, in some instances, to the local softening or liquefaction of part of the tumour, or to an accumulation of fluid in the interspaces of the intersecting bands; in others, to a process of cyst formation corresponding to that in cystic disease of the breast. These two changes have suggested to some the names of the "fibro-calcareous," and the "fibro-cysted" tumour.

Fibro Calc

— Cyst

A multiplicity of fibrous tumours is not unusual in the nerves and the uterus, but in other situations they are single.

Treatment.—The proper treatment is removal at an early period, and in most of the situations, the only proper proceeding for accomplishing removal is excision. The preferable mode of effecting removal in the case of fibrous tumour of the nostrils, constituting fibrous polypus, will be described in the section on Affections of the Nose.

NEUROMA.

By neuroma is meant a fibrous tumour which is very frequently found connected with the spinal nerves, sometimes with the cerebral nerves arising from the medulla oblongata, and Bérard mentions a case of its occurrence in a ganglionic nerve. Neuromata vary in size from that of a millet seed or pea, to that of a large egg or small melon, are of a round or ovoidal form, having their long diameter parallel to the nerve from which they spring, and occur either as solitary tumours, or in vast, almost countless numbers, diffused throughout the spinal nervous system. Mr. Smith, of Dublin, who has written a most excellent monograph on the subject, mentions a case in which he found upwards of 200 neuromata on the chest and abdomen, 150 on the right lower extremity, and upwards of 300 on the left. They are of a grayish or yellowish-brown colour, have a solid, firm, inelastic feel to the touch, and admit of motion in the transverse but not in the longitudinal direction. With respect to their position on the nervous trunks, Rokitansky states, "The tumours lie between the fasciculi of the nerve, and are interwoven with their neurilemmatous sheath; and it is a remarkable, and no less important general rule, because of the symptoms which may result from its presence, or which may be set up by operations performed on it, that neuroma is never deposited in the centre of a nerve, but at its side, so that only a small part of its fasciculi is displaced; the displaced fasciculi are spread abroad and stretched over the tumour, while the greater mass of the nerve remains on the other side uninjured, and with its fibres in connexion with one another."

Anatomical Characters.—Neuromatous tumours consist essentially of a fibrous stroma, the filaments of which have a wavy outline, and run parallel to each other, or interlace with one another. Scattered throughout this stroma there are frequently found groups of cells more or less closely aggregated together.

vities

On incising neuromatous tumours which have attained a considerable size, small cavities are frequently discovered filled with a variously coloured serous or gelatinous-like fluid, which is probably the result of a disintegrating process set up within their central portions.

This form of tumour occurs in both sexes, and at all periods of life, and arises either spontaneously without any known exciting cause, or in consequence of some external injury, or, as very frequently happens, it follows upon amputation of a limb.

Neuromata are very frequently attended with intensely sharp lancinating pain, which is much increased by handling the tumour, but, curious to say, in some instances where they have occurred in vast numbers, they have been accompanied with little or no pain whatever.

When the tumour is single and attended with intense pain, it is frequently called by the name of the painful subcutaneous tubercle.

Treatment.—The only proceeding by which surgeons endeavour to accomplish a cure of neuromata is, excision by the knife; but this mode of practice, though suited for the majority of cases, is, under certain circumstances, unjustifiable; and in certain cases not advisable.

peration
justifiable

In those rare cases where almost every spinal nerve in the body is studded with tumours, operative interference is not justifiable; and in many cases where the tumours are few in number and unattended with pain, it may not be advisable to have recourse to the knife, unless the tumours, either from their size, or from their position, occasion the patient much inconvenience, and he himself be anxious for their removal. In all cases, however, where there is but a single tumour, or where the neuromata are very few in number, where there is great pain, and where the patient is willing to submit to an operation, excision by the knife is the proceeding resorted to with the hope of accomplishing a cure. I lately removed a neuromatous tumour from the median nerve which had caused most excruciating pain, especially during the night. It was much larger than an egg, and the patient recovered without a single unpleasant symptom, and soon regained her health and strength, which were greatly injured by the severe nocturnal pain and want of sleep.

3. FATTY TUMOUR.

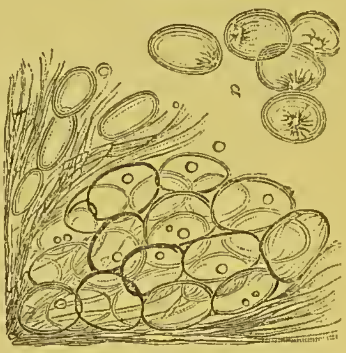
Professor Paget remarks, "There are both continuous and discontinuous morbid hypertrophies of fat; both fatty outgrowths, and fatty tumours, more properly so called. M. Lebert distinguishes the fatty tumours according to their degrees of isolation, as Lipoma circumscriptum, and Lipoma diffusum."

Lipoma
circumsp
Diffus

Seats.—Fatty tumour is found in all parts of the body, and at all periods of life, but most frequently under the common integument of the trunk, thighs, and shoulders ; and although quite usual in both sexes, it is oftener met with in females than in males. A remarkable fact is, that they sometimes leave the spot where they began to grow, and take up another position.

Characters.—The principal characters of this tumour are, that it is painless, lobulated, elastic to the touch—which elasticity sometimes simulates fluctuation—exceedingly moveable, and has the characteristic softness and pliancy of fat. The simple form, called simple lipoma, feels much lobulated ; the encysted form feels globular and doughy, and is but loosely connected with surrounding parts. By these characters the diagnosis is generally made very easy. From deep-seated abscess, and from encephaloma, this form of tumour is distinguished, not only by the symptoms just described, but also by the absence of the characteristic signs of those affections.

Fig. 39.



Structure of a fatty tumour removed from the back. *a.* Isolated cells, showing crystalline nucleus of margaric acid.—From BENNETT.

Varieties.—There are several varieties of fatty tumour : 1. Lipoma simplex, the true fatty tumour, with little appearance of areolar tissue. 2. Lipoma mixtum, in which the fat cells are more or less separated from each other by penetrating portions of areolar tissue. In some cases, as in simple lipoma, the fat cells are diffused among, not distinctly separated from, surrounding parts ; but in most, there is a fine cyst of cellular tissue to which the tumour is very loosely attached ; but sometimes it is thick, and so much so as to give the appearance of an encysted tumour, although, the cyst and its contents being connected by organized structure, the essential condition of an encysted tumour is wanting. 3. Müller describes what he calls Lipoma arborescens, "ramifying productions consisting of fatty tissue, and occurring in the joints, especially in the knee-joint. Growths of this sort are covered by a prolongation of the synovial membrane, and hang loosely in the cavity of the joint, forming arborescent tufts somewhat swollen at their extremities."

Arbore

The state of parts in simple lipoma will be described under the head of Lipoma of the Nose.

Treatment.—All attempts at discussion should be avoided, as being not only useless, but calculated to be injurious, by exciting irritation, inflammation, adhesions, incorporation with surrounding textures, and perhaps degeneration of the tumour. Removal by operation, than which few things can be more easy, is the only judicious proceeding. The cyst having been opened by incision, evulsion of the tumour is very readily effected by the finger alone, or by the finger and an occasional touch of the knife; dissection may be said to be scarcely required, unless incorporation with surrounding parts, adhesions or degeneration have been previously produced by stimulation or some other kind of injudicious treatment. The operation for lipoma of the nose will be afterwards described.

4. ENCYSTED TUMOURS.

Synonyms.—Encysted tumour, cystic tumour, and cystic sarcoma.

Seats.—Encysted tumours are met with in many different situations, but are most frequent in the mamma, in the testicle, and under the common integument of the head and face; they are comparatively rare in the limbs.

Characters.—It has been already stated, that fibrous and fatty tumours are found enclosed in cysts. In all such cases, the cysts constitute the means of connexion between the tumour and the surrounding parts, and an organized structure connects the cyst and its contents with each other; but the distinguishing peculiarity of those tumours to which alone the term encysted is applied, is that they have no organized means of connexion between the cyst and its contents. Encysted tumours are generally more or less of a globular form, unattended with pain or tenderness; the surface is usually unequal; the tumour feels solid at some parts; and there is more or less of fluctuation, depending on the number, size, and contents of the cysts.

Varieties.—Encysted tumours present great varieties, the principal of which are the following:—

First. Cystic tumours with simple cysts, the cysts being smooth or only marked by a few eminences. The cysts in different tumours differ much in thickness and in their contents, which are sometimes thin and watery, sometimes glairy, sometimes gelatinous, sometimes of a blackish appearance. In some instances where there has been irritation, they are of a purulent character; in others, they consist of various extractive matters and salts; sometimes they are of the consistency of honey, pap, or lard; and hence the terms meliceritious, atheromatous, or steatomatous. In some rare cases, the cysts have been found to contain hairs, teeth, horny structure, and true bony substance. This variety is named cystosarcoma simplex.

Second. The parent cysts in many instances contain smaller cysts in their interior, attached to the walls by pedicles. This variety has been called cystosarcoma proliferum.

Third. A third variety is called cystosarcoma phyllodes, "in which the cysts, included in a sarcomatous substance, are ill-defined, form several cavities and chambers without a distinct proper membrane, and are filled more or less completely with solid, foliaceous cauliform growths from the floor and walls of the cavity. This form corresponds with the cystic formations, where solid granulations spring exuberantly from the walls of the cyst."

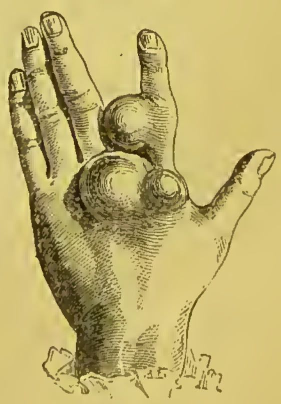
Treatment.—The proper treatment is, to remove the tumour by excision; but the mode of proceeding varies in some respects according to the situation of the tumour and its firmness of connexion with the surrounding parts. If it be loosely adherent, as is usually the case when it is situated under the scalp, removal may be very quickly effected by making a longitudinal incision of the integument without opening the cyst; and the cyst and its contents may then be very quickly removed by pressing the integument on each side of the tumour, or by the use of a hook or forceps, or by pressing it out with the handle of the instrument. If the cyst and superimposed integument be at any part firmly adherent, it is better to commence the operation by making an elliptical incision comprehending the adherent part of integument. If the cyst be firmly incorporated with the surrounding parts, then, in some situations, dissection is preferable to any of the above-named methods of evulsion, and in others the sac should be opened and its interior touched with nitrate of silver. And if the whole of the cyst in any particular case cannot be removed, as is not very unusual when these tumours form in the eyelids, it should be touched with a small bit of caustic to ensure its destruction.

5. CARTILAGINOUS TUMOUR.

To the valuable and elaborate investigations of J. Müller we are indebted for much information on cartilaginous tumours, which he designated by the term enchondromata. Chondroma, Enchondroma, Osteo-chondroma, and Benign Osteo-sarcoma are some of the names which have been applied to this tumour.

Seats.—Enchondromata may take place in the soft parts or in bone. Examples of the former are comparatively rare. J. Müller met with only four in thirty-six cases of cartilaginous tumour; and of these four, one was in the mamma, one in the parotid gland, and two in the testicle; glandular structures being the only soft parts in which he found the disease. Its most frequent seat in the soft parts is in or near the parotid gland. Of enchondroma of bone there are two varieties; *central enchondroma in the interior of bones*, commencing in the centre of the bone, and enclosed in a thin bony case; and *peripheral*

Fig. 40.



From Druitt.

enchondroma, beginning on the surface, and furnished only with a fibrous covering from the periosteum.

This disease is very common on the metacarpal and metatarsal bones; on the phalanges of the fingers and toes; on the femur and tibia near the knee-joint; on the humerus, the bones of the pelvis, and the ribs; indeed there is scarcely a bone on which cartilaginous tumours have not been seen. The accompanying delineation, copied from Druitt, gives a good idea of the appearance sometimes presented by this disease when situated in the hand.

For an exceedingly interesting and instructive account of the anatomy, physiology, and pathology of these tumours, the reader is referred to Professor Paget's valuable Lectures on Tumours, delivered in the Theatre of the Royal College of Surgeons of England, during 1851.

Ossification is the only change connected with these tumours which has been considered as a development. When the process is complete, the bone consists of thin cancellous tissue enclosed in a thin compact shell or covering.

The different kinds of degeneration to which cartilaginous tumours are liable, are the soft and the fatty; of which the former is the principal: in it, part of the tumour becomes converted into soft or liquid matter, which has been found to present great varieties of appearance. Mr. Paget thinks, that, although in many instances this substance appears to be formed by a liquefaction of the tumour, it may in some be a blastema in which the process of development has failed, and that it may therefore be a degeneration, or a defect of development. Some cartilaginous tumours have been found to contain a pulpy substance of a yellow colour, and it has been considered probable that this is the result of fatty degeneration.

These tumours commence more frequently before the period of puberty than later in life; sometimes they are numerous, as may often be observed in the hands and feet; the tendency to them has occasionally been found to be hereditary; and although a few cases are recorded in which they have been found to return after removal, such instances are very rare, and it may therefore be stated as a general rule, that they are innocent tumours.

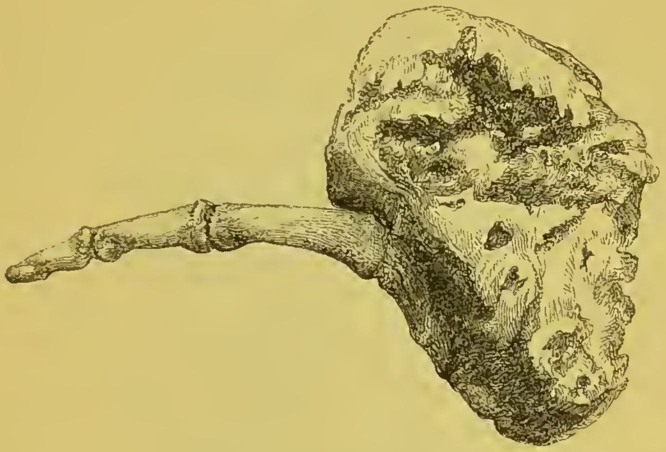
The accompanying figure, taken from a preparation in my collection, is a good representation of a cartilaginous tumour on the metacarpal bone of the forefinger.

The finger was removed many years ago, and the patient has ever since been perfectly well.

The conjunction of cartilaginous and medullary tumours is by no means unfrequent in some organs.

When cartilaginous tumours are deep-seated, their diagnosis from cancerous tumours is not easy. Professor Bennett in his work on cancerous and canceroid growths makes the following remarks on cartilaginous growths: "When enchondroma occurs in the extremities, and especially in the fingers and arms, is connected with the bones, and surrounded by an osseous capsule, its diagnosis from cancer is exceedingly easy. But when it is deep-seated, covered with soft parts, and has no distinct bony capsule, its detection is very difficult. It may thus be readily confounded with cancer of the bones, of which disease it presents all the general symptoms and signs; and if it be softened, it is not easily separated from cancer with the aid of the microscope, even after excision."

Fig. 41.



Remarkable example of ossification of enchondromatous tumour. From a preparation in my collection.

Treatment.—The only judicious method of treatment in a case of cartilaginous tumour is removal by excision, and that at an early period.

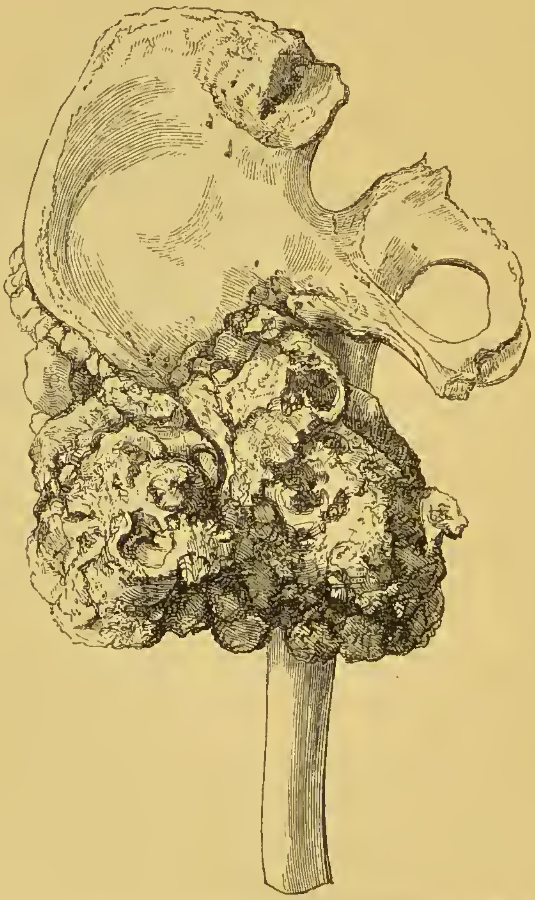
6 AND 7. CALCAREOUS AND OSSEOUS TUMOURS.

The occurrence of calcareous and osseous tumours is not unfrequent. The former consist of unorganized deposits of calcareous salts, and, properly speaking, constitute concretions. These concretions are found between various histological elements, and among other situations are met with in the parenchyma of organs, as, for example, in the testicle, in the mammary gland, and in the tonsils. They are also found in fibrous tumours, and in other structures of a fibrous character, and not unfrequently in the lymphatic glands, more especially in those of the neck and face, when they present the characters of a hard tumour, free from pain and tenderness, very moveable, and for which the proper proceeding is excision.

Osseous tumours are almost always met with in or upon bones. Examples, however, have occurred of osseous tumours formed of soft cancellous tissue and medulla, and completely isolated from bones. Among other examples of these extremely rare isolated osseous tumours, Mr. Paget refers to one in the Museum of the Royal College of Surgeons of England, and another in that of St. George's Hospital. The situation of the former was over the dorsal surfaces of the trapezial and scaphoid bones; the latter was imbedded in fibro-cellular tissue in front of the first metacarpal bone. Both tumours were perfectly isolated from the subjacent bones.

Osseous tumours have been divided into two kinds, the cancellous, and the compact or ivory-like: the former resembling the medullary tissue of healthy bone, and the latter, its compact walls. The difference in the density of the two kinds is ascribed not to any difference in the component parts themselves, but in the degree of closeness with which they are compacted together.

Fig. 42.

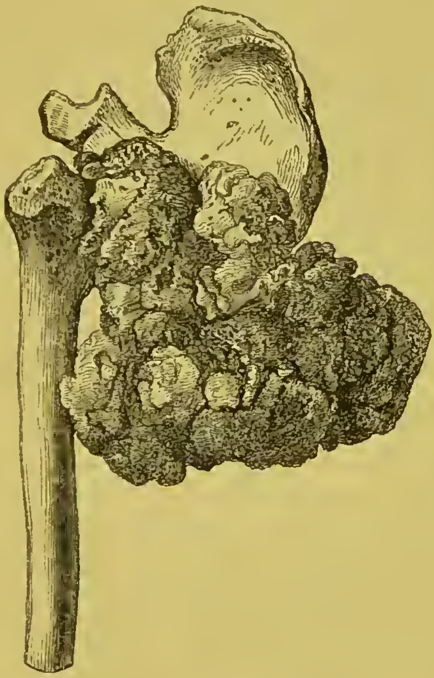


Remarkable osseous tumour of os innominatum. Front view. From a preparation in my collection.

Cancellous bony tumours are generally more or less round in form, and though somewhat smooth upon the surface, more frequently present numerous lobes and nodules. They are slow in their growth, but often attain a great size. Mr. Paget mentions that the largest he has had an opportunity of seeing is in the Museum of the Royal College of Surgeons of England. It surrounds the upper two-thirds of the tibia; and measures a yard in circumference. The largest I have seen is one in my own collection, of which the two accompanying figures are good delineations:—

It is an immense mass of bone attached to the os innominatum, cancellous in its interior, nodulated on its surface, and covered with a thin layer of compact bone. The patient laboured under the disease for ten years, and died in consequence of the sloughing of the soft parts. As the osseous tumour was uncombined with other elements, it cannot be said to be an example of osteo-sarcoma, under which appellation many include all tumours in which bone is mingled with soft tissue. The viscera were perfectly healthy.

Fig. 43.



Back view of same preparation.

The compact or ivory-like bony tumours are very seldom found except in connexion with the bones of the cranium, or in the lower jaw; more rarely in the latter situation than in the former. They sometimes grow from the outer table and diploe of the cranium, presenting the appearance of outgrowths of those parts; but more frequently originate in the tables of the cranial bones, especially in the frontal sinus; and as their growth advances, they press inwards upon the brain, and forwards on the eye, as well as outwards. These tumours have also been found in other situations, as on the humerus, and on the femur; but such instances are extremely rare. In the Museum of the Aberdeen Royal Infirmary there is a specimen of a very large tumour on the shaft of the femur, which appears to belong to this class. Its surface is uniform, and its structure throughout exceedingly hard, the component parts being firmly compacted together, and everywhere free from friability.

Osseous tumours, when uncombined with other elements, are invariably non-malignant.

The bony part of medullary tumours of bone differs from the cancellous part of osseous tumours, not only in being infiltrated with cancerous matter, but also in being more friable.

II. HETEROLOGOUS, HETEROMORPHOUS, OR MALIGNANT TUMOURS.

SCROFULOUS OR TUBERCULAR TUMOUR.

This tumour owes its peculiarity to the presence of a particular deposit, called tubercular exudation, or tubercle. These exudations occur most frequently in young subjects from about the third year to the adult period; they are most common during childhood and youth in the lymphatic glands, especially the cervical and mesenteric; and in adults, they are met with much more frequently in the lungs than in other parts. They are found in almost all tissues, and are common on serous surfaces, in areolar tissue, and, as we have already seen, in the testicle. In the common scrofulous affection of the lymphatic glands of the neck, and in scrofulous disease of the testicle, we have two examples of tubercular exudation, which frequently come under the consideration of the surgeon.

Tubercular tumour of the testicle will be described in the chapter on the affections of that organ, and for an account of the doctrines of tubercle, the reader is referred to the chapter on that subject.

The various forms of cancer constitute the remaining heterologous tumours, and they have already been described in the chapter on cancer.

VIRCHOW ON CELLULAR PATHOLOGY.

Having, although, it is feared, very imperfectly, described the principal phenomena of inflammation, and of tumours, and having noticed the products of simple tubercular and cancerous exudation—that these products are the results of cell-development in the various exudations, that tubercle stands lowest and cancer highest in the scale of cell-development, and that the changes and results in the various exudations are believed to depend on the inherent composition and constitution of the exudation itself, it may be proper to state, that an entirely new theory has been advanced by Professor Virchow, of Berlin, under the name of "Cellular Pathology, as the Foundation of Physiological and Pathological Tissue Doctrine." Virchow's "Cellular Pathology" is not yet translated, but a most excellent review of his work is contained in the number of the "British and Foreign Medico-Chirurgical Review" for October, 1859, from which the following extracts will be perused with great interest:—"With regard to cells, animal and vegetable, Virchow, following Remak, entirely discards the theory of formation given by Schleider and Schwann. He acknowledges no development of a cell in an amorphous blastema, by the successive formation of a nucleolus, a nucleus, and a cell-wall; and refuses assent to the doctrine that a cell originates in an aggregation of molecules, which then undergo a differentiation, so that some cohere to form a nucleus, and others form the outer wall by a still more intimate fusion. In the place of these views, Virchow advocates the principle, that in every case, physiological and pathological, in the vegetable as in the animal kingdom, *a cell arises only from a preexisting cell.* As regards animals, so also with cells, there is no *generatio æquivoca*, no spontaneous generation; one cell springs from another by endogenous growth, or by fissure and cleavage of nuclei and cells. This doctrine, if true, would at once necessitate an entirely different reading of many pathological phenomena. We are in the habit of saying that, in inflammation, for example, an exudation of albuminous or fibrinous substance is poured out between the tissues or on the free surfaces, and that this exudation then organizes itself into cells by spontaneous generation; and it has also been a creed that the said exudation, in virtue of, or from the absence of, special physical organizing powers, might either form perfect cells, or might develop into fibres, or, on the contrary, be unable to form cells in consequence of deficient or low a-plastic power. The whole of this doctrine Virchow rejects as an entire mistake; and he refuses even to use the term exudation in the sense in which it has been used by the Vienna school, and adopted in England—*i. e.*, as an effusion that may become organized. In 1831, Virchow, and almost at the same time Donders, described as dispersed through the homogeneous substance of the areolar or connective tissue certain cellular bodies, similar to, or identical with, the cells of cartilage and of bone (Bindegewebskörper). These bodies are described as round or spindle-shaped cells, separated by intercellular homogeneous substance, and from them proceed exceedingly fine canals, which anastomose with the canals coming from other cells, and thus is supposed to be formed throughout the areolar tissue a vast communicating system of vessels, through which nutrient fluid can pass; and which, in fact, form a system of circulation subsidiary and complementary to the circulation in ordinary bloodvessels. This view has given rise to great controversy, and has been especially combated by Heale, whose immense experience and assured judgment necessarily gives his opinion the greatest weight; while it has been more or less completely admitted by Leydig, Kölliker, and others, and has been adopted without hesitation, not only by Virchow's immediate school, but by many (Professor Weber, of Bonn, for example) who cannot be considered as the special followers of Virchow. Now, this view of the nature of the connective tissue is, we may say, a vital point in the doctrine of Virchow, for these corpuscles of the areolar tissue are made to play a most important part in pathology. From them are supposed to arise many, if not most, of the morbid growths; from them spring, in many cases, pus cells; and from them, in fact, is made to date the commencement of a vast number of pathological processes. If this docrine should be overturned, much of the newest pathological teaching rolls with it in the dust." According to Virchow's theory, pus cells, where strata of epithelium exist, are only altered epithelial cells, and in deeper parts purulent formations proceed from change in the connective tissue cells. He also believes that tumours do not originate from blastema, or exudation, but from continuous cell-growth, from some pre-existing cell; that, in the great majority of instances, the commencement of the tumour is to be found in the corpuscles of the areolar tissue; that cell-cleavage is the most common manner of growth; that in inflammation, and in tumours, the cells are supposed to be irritated to attract nutritive material; that the homogeneous and the benignant, as well as the heterologous and malignant tumours have a common origin; and that "heterology consists, in fact, only in a formation occurring in a place, or at a time, or in a degree, which is unnatural;" conclusions which Virchow denotes by the terms Heterotopie, Heterochronie, and Heterométrie. One of the many great objections brought forward to show the fallacy of the doctrine of the "Cellular Pathology" is that pus, cancer, and tubercle are all found in the white substance of the brain, where no cells have been demonstrated to exist, capable of increasing on the one hand, or degenerating on the other. It must also be admitted, notwithstanding the great admiration and respect entertained for Virchow, that many of his views are based on propositions still controverted, as, for example, the existence of areolar tissue corpuscles; that his statements embrace only part of the subject, and that they leave many of the most important phenomena of inflammation and of tumours quite unexplained.

CHAPTER VIII.

FRACTURES.

GENERAL DOCTRINES.

A FRACTURE, or solution of continuity of a bone, is said to be transverse, oblique, or longitudinal, according as it is at a right or an acute angle with, or parallel to, the long axis of the part of the bone in which it is situated. Where the condition of the bone, and that of the surrounding parts, is made the basis of arrangement, fractures may be divided into the following classes, namely, Simple, Compound, and Complicated fracture, Fracture with wound, Impacted, and Partial fracture. A fracture is said to be *simple*, when a bone is broken at one part without any co-existing injury of soft parts; *compound* or *open*, when there is an open wound of the superimposed parts, communicating with the fracture; *comminuted*, when the bone is broken into several fragments; *complicated*, when, together with the fracture, there is serious injury of the adjoining structures, as laceration of vessels, or of other important parts, or serious contusion of the superimposed tissues; *fracture with wound*, when the wound does not communicate with the fracture; *impacted*, when one fragment is lodged in the other; and *partial*, when the continuity of only part of the osseous fibres is interrupted. This last variety has been called by some *bending with partial fracture*, and by others green-stick fracture. Bending sometimes takes place without fracture; but I have seen cases which I am convinced were cases of bending with partial fracture.

SIMPLE FRACTURE.

The principal symptoms of fracture are pain, obvious deformity, preternatural mobility, crepitus, and inability to move the affected limb; but as the symptoms and causes of the particular fractures will be minutely described, it is unnecessary to refer to them under the head of general doctrines.

The mode of Union.—The new bone that constitutes the bond of union is named callus. The production of callus has been studied with the greatest care by Haller, Duhamel, Bordenave, Hunter, Dupuytren, Breschet, and Villerme, and more recently by Paget and Stanley. Dupuytren made many experiments in dogs, rabbits, birds, and other animals, and, as the result of those experiments, he arrived at the conclusion that nature never accomplishes the union of a racture without two successive deposits of callus, the one of which he names the *provisional*, the other the *permanent*. The first he believed to be perfected in from thirty to forty days—the production and complete organization of the other, he believed, required eight, ten, or twelve months.

Dupuytren arranged the phenomena from the occurrence of the fracture to the exact and complete re-union into five different periods or stages.

In the first stage, comprehending a period of eight or ten days, blood is extravasated into the medullary canal, between the fragments, and under the periosteum, raising up the latter from the bone for some distance above and below the fracture. The medullary membrane becomes swollen and separated from the bone, and the periosteum is not only raised up from the bone, but it also becomes red, soft, swollen, and preternaturally vascular. The fragments of bone may thus be said to be surrounded with blood, which not only fills the medullary canal and the space between the fragments, but also separates the latter from detached periosteum. This blood becomes absorbed, and liquor sanguinis is effused into the parts at first occupied by extravasated blood.

In the second stage, comprising the interval between the tenth or twelfth day to the twentieth or twenty-fifth, the tumour of callus, as it is called by Dupuytren, is formed. The substance between the periosteum and bone is converted into a structure like fibro-cartilage, and within the medullary canal there is also developed a fibro-cartilage, but the substance between the fragments retains the appearance of coagulable lymph.

In the third stage, extending from the twentieth or twenty-fifth to the thirtieth, fortieth, or sixtieth day, according to age and strength, the fibro-cartilage between the periosteum and bone, and that within the medullary canal, are both converted into bone, the external forming a ring, or ferule, or clasp, and the internal a plug, or peg (cheville), filling up the medullary canal, and together constituting what Dupuytren calls the provisional callus. The external ring, embracing both fragments, and the plug within the medullary canal constitute nature's provision for keeping the fragments in apposition and at rest. The substance between the fragments is, during this stage, changed into fibro-cartilage.

In the fourth stage, extending to the fifth or sixth month, it is converted into bone, constituting what Dupuytren called the permanent or definitive callus.

The fifth stage extends from the fifth or sixth month to the tenth or twelfth, during which the provisional or temporary callus, being no longer necessary, disappears, and the medullary canal is restored.

Such are the views of Dupuytren on this interesting subject; and, until lately, they were generally received as the correct explanation of the successive changes that take place, both in man and in the lower animals, from the occurrence of fracture until the injury is completely repaired.

Mr. Paget, in his exceedingly interesting and philosophical "Lectures on Repair and Reproduction" after injuries, has brought forward different views from those which formerly prevailed regarding the repair of a fractured human bone, and has supported his opinions by most conclusive evidence. His views on this subject are in accordance with those of Mr. Stanley.

In reference to the description given by Dupuytren and others, of the examination of fractures in dogs, rabbits, birds, and other animals, Mr. Paget remarks :—"All that is written in these accounts of external and internal, provisional callus and definitive callus, of the formations of cartilage and bone within the medullary tube, and beneath the periosteum, can be traced only, as it were, in rudiment in the fractures of the human bones. There is scarcely a specimen in the Museum of such provisional callus formed in the repair of a fractured human bone; in nearly every case of such fracture, the material of repair is only inlaid between the broken surfaces, or between the adjacent parts of the fragments, and unites them by being fixed to both. In favourable conditions, this appears to be the usual mode of repair, even though the fragments of the broken bone be very much displaced. I have examined many more specimens, and find the same rule true; namely, that in the ordinary repair of simple fractures in the human subject, the reparative material, or callus, is merely inlaid between the several fragments; it fills up the interspaces between them and the angles, at which one fragment overhangs another, but it does not encircle or ensheath them in the manner explained in the description of provisional callus; nor is it in any considerable quantity, if at all, deposited either beneath the periosteum or within the medullary tube. In birds, dogs, and other ordinary subjects of experiments, the formation of a provisional, or, as it may perhaps be better called, an ensheathing, callus is usual."

In evidence that the reparative material is placed not within and around the fragments, as an ensheathing, but between them, as an intermediate callus, Mr. Paget not only adduces many fractures long after they have been completely healed, but as these might be deemed insufficient, he refers also to many recent specimens, at four, five, six, eight, nine, eleven, twelve, and sixteen weeks, and many others at unknown dates after the fracture. The only exceptions to the difference in the mode of repair of human bones and those of the lower animals, the only instances in the human subject in which, under ordinary circumstances, provisional callus is formed, are in fractures of the ribs, and, although much more rarely, of the clavicle.

According to Mr. Paget, other remarkable differences between the reparative process in man and in the lower animals, are—that in man no change of any importance occurs for a week or ten days, and the periosteum remains without being raised up or in any way particularly changed, except that it becomes slightly thickened and more vascular.

The first new material produced is liquor sanguinis, which, according to Mr. Paget's observations, sometimes passes into perfect fibrous tissue, sometimes into fibro-cartilage, and occasionally, although very rarely, into true cartilage. On this subject Mr. Paget remarks :—"In different specimens, or sometimes in different parts of the same, the reparative material may display, in one, fibrous tissue, with a few embedded corpuscles, like the large nearly rounded nuclei of cartilage cells ; in another, a less appearance of fibrous structure, with more abundant nucleated cells, having all the character of true cartilage cells ; and, in a third, a yet more perfect cartilage."

Treatment.—The local treatment of simple fracture may be said to consist in fulfilling the four following indications :—first, bringing the fragments into a proper position, which is technically called reduction,—this should be done as soon as possible ; second, maintaining the parts in this position, or preventing any displacement ; third, preserving the parts at rest until union be accomplished ; and fourth, obviating any untoward symptoms. The proceedings to be adopted for fulfilling these indications will be minutely explained in the description which will be given of the treatment suitable for each particular fracture.

COMPOUND FRACTURE.

Definition.—A fracture is said to be compound, or open, when there is an open wound of the superimposed parts communicating with the fracture.

Causes.—Fracture may be rendered compound at once, by the injury which fractured the bone ; or subsequently, by one or other of the fragments being thrust through the skin ; or at a more remote period, by ulceration and sloughing of the superimposed soft parts.

Dangers.—The dangers of compound fracture may be arranged into those which are in a great measure immediate, and those which are remote. The first class comprehends the shock and collapse of the injury, which may prove fatal in a short time ; hemorrhage, which, alone or along with shock, may lead to the loss of life ; traumatic gangrene, in consequence of the extent and severity of the injury, of which I have seen many examples, chiefly in cases of severe railway accidents ; tetanus ; and gangrene, and rapid disorganization during the supervening inflammation, the part and system being so much weakened as to cause the former to fall a victim to the inflammatory process. The dangers belonging to the second class, or, as they have been called, the remote or prospective dangers, are, hectic fever, in consequence of profuse wasting, protracted suppuration, abscesses with or without exfoliation or slow necrosis of the bone, erysipelas, phlebitis, and pyæmia. Such are the frequent sources of loss of limb or life in cases of these injuries.

Mode of Union.—The process of repair is usually much more tedious than in simple fracture, and does not commence, when inflammation has become established, until it abates. The union resembles, in some measure, that by the second intention in soft parts, and is effected through the medium of granulations which arise on the ends of the fragments, and ultimately become ossified.

Question of Amputation.—The first point that demands the consideration of the surgeon is, whether an attempt should be made to save the limb. In slighter cases, the duty of the surgeon is clear and pleasant—namely, to save both limb and life; but, in cases of great severity and complication, it is equally evident that it is his painful duty to sacrifice a part to save the whole, or, in other words, to sacrifice the limb to save the life. The principal conditions which demand amputation are, extensive removal of soft parts, or such severe and extensive contusion of them as makes it certain that sloughing to a great extent must take place, an extremely shattered or comminuted condition of the bones, fracture at several parts, extension of fracture into an important articulation, division of the principal blood-vessels, laceration of an important artery with such injury of a vein as to constitute an obstacle to venous return, a condition of blood-vessels which rapidly induces gangrene, great infiltration of parts with blood, and more especially if part of the integument be torn off, and the intermuscular spaces extensively infiltrated, the advanced age of the patient, enfeeblement of system from disease, intemperance, or previous loss of blood, and a corpulent habit of body in a person addicted to indolence and luxurious living. Such are the chief conditions which render it judicious for the surgeon to recommend immediate amputation, rather than endanger the life of the patient by a vain attempt to save the limb. The proper period for the performance of amputation is, so soon as the shock of the injury has sufficiently passed away, and before the accession of irritative fever. When this period has arrived, the sooner it is performed the better for all parties concerned; but, if that period be allowed to pass by, another may not occur in which an operation could with safety be performed. Such is the proper period for primary amputation, and such the principal conditions that render the proceeding justifiable and necessary. But, in reference to the question of amputation, cases of compound fracture may be arranged into three classes. First, those in which it is clear that an attempt should be made to save the limb; second, those in which it is equally clear that it is our duty to remove the limb; third, those of decided doubt. In cases belonging to this last class, my decided impression is that, from our admiration of conservative surgery, and our anxiety to avoid unnecessary operations, we are far more in danger of jeopardizing a patient's life by an attempt to save an injured limb, than of performing an unnecessary operation. I have often reflected on my own experience of such cases, both in hospital and in private practice; and although I have always been firmly convinced that I never yet removed a limb which by any possibility could have been saved, I have arrived at the painful belief, that on more occasions than one, I should have done better by not attempting to save the limb.

Treatment.—The first consideration is the reduction of the fracture. In many cases this may be done by putting the limb into the most favourable position for relaxing the muscles, and by cautious and well-directed extension and counter-extension, along with proper manipulation. If the fracture be transverse, these means will always be successful: but if it be oblique, they may fail; and then it becomes advisable to enlarge the wound by dividing the skin which embraces the bone, or is placed underneath it, to admit of replacement of the fragments. In some cases, however, replacement can neither be effected nor maintained without sawing off the sharp projecting ends of the fragments, a proceeding, when necessary, that must be gone about with great caution, so as not to strain the soft parts unnecessarily, or to injure them with the saw. The edges of the wound, in all cases, should be carefully approximated by sutures and bits of plaster, aided by collodion, to exclude the air; the limb should be placed in the best position for relieving tension of muscles and favouring venous return, and laid on Liston's splint or enclosed planes, or a swing-splint, or some of the many other kinds of special apparatus suitable for the situation and kind of injury. Along with the use of these means, every endeavour should be made to moderate the local inflammatory action, and lessen the constitutional irritation. For fulfilling the first indication, light water-dressings, the lightest possible bandaging that will serve the purpose of a retentive appliance, irrigation, or cold evaporating lotions, the use of a splint with an aperture corresponding to the wound, so as to make movement of the limb during dressing unnecessary, and the removal of all pressure or weight of bed-clothes by means of a cradle, are our principal remedies. For fulfilling the second indication, the bowels must be carefully regulated, all sources of irritation should be avoided, the diet should be light, every avoidable movement should be guarded against, and constitutional irritation removed by opiates, if requisite. By these means, a compound fracture is occasionally changed into a simple one, by union taking place in a few days. When this desirable end is not obtained, as, unfortunately, is too often the case, notwithstanding the most judiciously directed local and constitutional treatment, light water-dressings should still be continued, but changed to tepid water when suppuration comes on; all tension from matter should be removed by incision, when necessary, whether the matter be infiltrated or in the form of abscess; all undue handling or movement of the limb, all pressure to squeeze out matter, and the slightest degree of injurious compression from tension of bandages, should be anxiously guarded against. The utmost attention to cleanness, by the removal of all soiled dressings, is important; and, in some cases, syringing out cavities where matter has been lodged, and carefully employing compresses, will be found beneficial. The strength of the patient should be supported, and his health as much as possible maintained by good diet, wine, tonics, preserving the air in his room as pure as possible without chilling him, free admission of the light of the sun, a proper condition of his bed and bedding, encouragement, and all other means necessary and judicious in the particular circumstances of the case. Should gangrene invade, the treatment should be conducted on the principles laid down when speaking of that state in the first chapter of this work. Secondary amputation may be required, not only on account of the invasion of gangrene, but in consequence of the strength of the patient failing, from irritation or asthenic fever, induced by general disorganization of the limb, or hectic fever, resulting from profuse suppuration and necrosis of the bones. The proper period for secondary amputation for the last-mentioned conditions is when its necessity is clearly demonstrated, and while the patient has sufficient strength to bear the shock which must necessarily be induced by its performance, and before he is run down to such an ebb as to make it probable that, should he survive the shock of the operation, he will fall a victim to some low diffuse form of the inflammatory process, to intercurrent and visceral congestion, to erysipelas, to phlebitis, or to pyæmia. The operation having been performed, in many cases nourishment, stimulants, and opium require to be administered, in extremely liberal doses, to prevent the patient from sinking. In many apparently desperate cases in our hospital, in which I have had the gratification of seeing at last the desired result, in addition to nourishing diet, I have, with the greatest benefit, prescribed for many days, six ounces of brandy, ten ounces of wine daily, and a grain of opium three times in twenty-four hours.

FALSE JOINTS.

Ununited Fractures—Causes.—A fracture may fail to unite owing to constitutional or local causes. The principal constitutional causes which interfere with the reparative progress are—a scorbutic, rheumatic, gouty, syphilitic or phthisical state of system, or debility from loss of blood, intemperance, want of sufficient food, long-continued fever, or exhausting disease, senile atrophy, loss of nutrient power, or want of nervous influence, however induced. Paralysis and similar affections are well known to interfere with the reparative process. The experiments of Roechling on animals, on this subject, are very interesting. Pregnancy and age have been supposed to interfere with the proper union of fractures; but, judging from my own experience, if they have any influence, it must be much less than some have imagined. The most common local causes are—want of proper apposition, the fragments not being preserved perfectly free from motion, excess of the inflammatory process, however induced, a necrosed portion of bone, the interposition of portions of muscle or tendon between the fragments, and the anatomical condition of the fragments in regard to arterial supply. The influence of this last-mentioned cause is strikingly exemplified in fracture entirely within the capsular ligament of the hip-joint, and sometimes in fracture of the anatomical neck of the humerus, when so placed that the broken-off ball is entirely within, and has no attachment to the capsular ligament, that is, when the articulatory portion only constitutes the upper fragment. A due supply of blood to both fragments appears to be essential for perfect union. When the articulatory portion of the humerus is broken off, it is entirely deprived of all vascular supply, and not only may there be no union, but the fragment within the joint is sometimes found to become necrosed. In fracture within the capsular ligament of the hip-joint, there being still some blood carried to the upper fragment through the vessels of the round ligament, necrosis does not take place; but the defect of supply is such as to make union by bone a matter of extremely rare occurrence. Guertin has given great attention to this subject, and has brought forward cases to show that ununited fracture is sometimes the result of defective supply of blood, caused by rupture of the nutritious artery of the broken bone. Curling has shown that atrophy of the bone is sometimes the result of the interruption of arterial supply from the same cause. The investigations of Guertin, Curling, and Adams on this subject are full of interest, and highly deserving of perusal. It is found that, if the supply of blood be cut off to any particular extent, by injury of the nutritious artery, so that the periosteum has exclusively the duty of nourishing the fragments, either one or both pieces become atrophied, their walls being visibly thinned, as well as their areolar structure.

Disunited Fracture.—After consolidation has taken place, disruption may be induced by fresh mechanical violence; or it may result from inflammation, suppuration, and ulceration, or in consequence of any of the constitutional states described, when treating on the constitutional cause of ununited fracture.

State of parts of False Joints.—On this subject Rokitansky remarks:—"The unnatural joints, which result from fracture, are of two different kinds; one more or less resembles a synchondrosis; the other is like diarthrosis, and is, accordingly, in its proper sense, a new joint. In the former case, the fractured ends of the bone are held together by ligamentous tissue. Either a disc of ligament, the thickness of which may vary, is interposed between them, and allows of but little movement; or, as occurs when there has been loss of substance, ligamentous bands connect the fragments, and allow them to move freely on each other. The connecting substance appears to be nothing but the *substantia intermedia* mentioned above, which, as the formation of the secondary callus has failed, or been insufficient, remains in its first state. In the second case, a ligamentous articular capsule is formed, and is lined by a smooth membrane, which secretes synovia; the fractured surfaces adapt themselves to each other, and become covered with a layer of tissue, which is fibro-ligamentous, or more or less fibro-cartilaginous, or which resembles, and sometimes (Howship) really is, cartilage; they then articulate immediately with one another, or may have between them an intervening layer of ligament, which corresponds to an interarticular cartilage; and their movement on each other is more or less free, according to the size of the articular capsule, and the form of the articulatory surfaces. These last are sometimes horizontal or smooth; they glide over each other, and allow of restricted motion; sometimes the one surface becomes convex, and the other concave; sometimes both are rounded off, and lying within a capaciously articular capsule far apart, they come in contact only during particular movements. The articular capsule is the product of the inflammation of the soft parts; the cartilaginous layer, which covers the ends of the bone, is secondary callus arrested in its metamorphosis, and converted into fibroid tissue; the other ligamentous cords, which are sometimes present, and the structures resembling an interarticular cartilage, are remnants of the *substantia intermedia.*"

Treatment.—If the want of union be owing to constitutional disorder, the grand indication to be fulfilled is, the removal of that state as speedily as possible. The general health should be maintained, the power and vigour of the system kept up by generous diet, tonics, and stimuli, if required, and the parts should be placed in proper apposition, and kept at perfect rest by starch bandage or other suitable appliance. Energy of system being duly sustained, and favourable local conditions for local repair being secured, the desired result will no doubt be obtained. After a patient has remained for weeks in bed, without union being effected, I have often found consolidation take place very soon, in consequence of the limb being bound up afresh with starch bandage, and the patient being drawn out into the open air, and allowed occasionally to move on crutches, the improvement of the general health securing sufficient energy of repair. When months, however, have elapsed, from the occurrence of the injury, and a false joint has been formed, some operative proceeding becomes necessary, before union can be attained. Some of the many proceedings which have been had recourse to are:—Friction of the ends of the fragments against each other, as recommended by

Celsus, and practised by some modern surgeons, repeated in five or six days, care being taken to preserve the parts at rest in the interval —cautious, steady, persistent pressure, as recommended by Amesbury, and kept up by leather splints, or some special apparatus—White's proceeding of cutting down and sawing off the ends of the fragments — the proceeding of Dr. Physick, of introducing a seton between the fragments, allowing it to remain until suppuration is established, withdrawing it, and binding up the limb carefully, and maintaining it at perfect rest—the method of Hunter, consisting of cutting down upon the artificial joint, and irritating the surfaces forming it by means of a spatula—Burman's treatment, which consists of the application of galvanism as an exciting agent—Professor Brainard's practice of introducing a perforator, piercing the fragments at various points, cutting up the interposed tissue between the surfaces, and binding up the fracture in the hope of ossification taking place—lastly, the proceeding of Horeau, generally condemned in Europe, but favourably viewed by many in America, owing chiefly to the recommendation of Rodgers, which consists of cutting off the points of the fragments, drilling a hole through each, and tying them firmly together by a silver wire, so as to keep them closely and evenly together during the consolidating process. Of the above proceedings, the only one of which I can speak from personal experience, is that of White, namely, cutting down upon the joint, and sawing off the ends of the bones. In many cases this would be a very formidable proceeding; but in two very favourable for such an operation, I adopted it with perfectly satisfactory results. There are other two operations, however, which I look on with more favour than any of the methods of operation I have above described, namely, the proceedings of Dieffenbach and of Miller. Dieffenbach's treatment consists of cutting down upon the fragments, piercing them at several points with a gimlet, introducing ivory pegs into the perforations, and allowing them to remain for some weeks. Both fragments must be perforated at several points, but the object is not to pin together the fragments of bone. The presence of the foreign bodies excites the necessary amount of action; and in many instances, especially in fractures of the humerus and femur, gratifying results are obtained. Miller's treatment consists in introducing a long tenotomy needle through the integument, passing it down to the joint, and cutting up the ligamentous bond of union, as well as the self-investing tissue on the bones, covering the opening with collodion and plaster, and binding up the fragments, and keeping them at rest. I have been much gratified with the results of both these proceedings, and I have no doubt that, in certain cases, they will generally lead to the necessary amount of reparative action.

SPECIAL FRACTURES.

FRACTURES OF THE FORE-ARM.

Fractures of the fore-arm are more frequent than those of any other part of the body. Desault found, in the record which he kept of such cases, that they occupy the first place. Dupuytren arrived at the same conclusion, as the result of his experience at the Hôtel-Dieu; and Mr. Lonsdale also, who gives a table of nineteen hundred and one cases, found these to be the most frequent, and to form one-fifth of all fractures.

In treating of these fractures, it is proposed to consider—First, The Classification, or arrangement of them; Second, The Comparative Frequency of Cases belonging to each Class; Third, The Symptoms and Nature of the Displacement peculiar to each Fracture; and Fourth, The Treatment proper to each Class.

I. CLASSIFICATION.

Fractures of the bones of the fore-arm may be divided into three classes:—

1. Fractures of the radius; 2. Fractures of both bones; and, 3. Fractures of the ulna.

II. COMPARATIVE FREQUENCY OF CASES BELONGING TO EACH CLASS.

From the following statistics of the Hôtel-Dieu, it appears that the cases belonging to the first class are more numerous than those of the second; and the second more numerous than the third. Dupuytren records, that in 1829 there were brought to the Hôtel-Dieu one hundred and nine fractures, of which twenty-three were of the fore-arm, and of these sixteen were of the radius alone, five of both bones, and two of the ulna alone: and that, in 1836, there were ninety-seven fractures, of which twenty-two were of the fore-arm; and of these, sixteen were of the radius, four of both bones, and two of the ulna alone. These results are in accordance with the experience of most surgeons. But Mr. Lonsdale has given a table exhibiting a different result as to the comparative frequency of cases of the second and third classes. He found that of three hundred and eighty-six fractures of the fore-arm, one hundred and ninety-seven were of the radius alone, ninety-six of the ulna, and ninety-three of both bones. These statistics show that by far the greater proportion of fractures of the fore-arm, are fractures of the radius only;—a fact not difficult to be accounted for, when it is remembered that the radius may not only be broken by direct violence applied to itself—to which it is also more exposed by its position as the outer bone, but also by violence applied to the hand, which is supported by the radius.

Fractures of the right radius are more frequent than of the left. Dupuytren found that of ninety-seven cases, fifty-nine were of the right, and thirty-eight of the left radius.

III. SYMPTOMS AND NATURE OF THE DISPLACEMENT PECULIAR TO EACH FRACTURE.—FRACTURES OF THE RADIUS.

1. *Situation.*—Fractures of the radius may take place in any situation; they occur more frequently at the lower, than at the upper extremity, and still more frequently about the middle of the bone. M. Velpeau states that fracture of the ulna is found more frequently below than above, and of the radius, on the contrary, more frequently above than below. This he probably inferred from the circumstance that the lower extremity of the ulna is smaller than the upper, while the reverse is true with regard to the radius. Most surgeons, however, maintain that fractures of the radius are not so frequent at the upper as at the lower extremity.

Fracture at the neck is an exceedingly rare accident. Sir Astley Cooper says:—"This fracture I have heard mentioned by surgeons, as being of frequent occurrence, but there must be some mistake in the statement, for it is an accident which I have never seen, and if instances ever present themselves, which I do not mean to deny, they must be very rare." M. Velpeau's statement with regard to the ulna agrees with general experience.

2. *Causes.*—The radius is fractured by violence, applied either directly to the bone itself, or indirectly through the hand; for instance, when a person falls on the hand, the radius receives the shock from the hand, the upper part receiving the whole momentum of the body from the humerus, while the lower part rests against the hand upon the ground; the radius bends, and, if the force be sufficiently violent, gives way—generally near the middle. This fracture is more frequently occasioned by a fall on the palm than on the back of the hand. Out of fourteen cases, Dupuytren found that three were owing to falls on the back of the hand, and eleven to falls on the palm. Cruveilheir, therefore, was mistaken in believing that the radius could not be fractured by a fall on the back of the hand.

3. *Symptoms.*—Pain, loss of the power of voluntarily effecting the movements of pronation and supination, and the prone position of the hand are indicative characters of this injury. There are also other symptoms which deserve attention, namely, a motionless condition of the head of the bone during pronation and supination, crepitus, a diminution of the transverse measurement of the fore-arm occasioned by the fractured portions falling into the interosseous space, and projection of the fractured ends on the back of the fore-arm, when the hand is very forcibly bent. If the fracture be in the middle, or in the lower two-thirds, it may be felt by the finger.

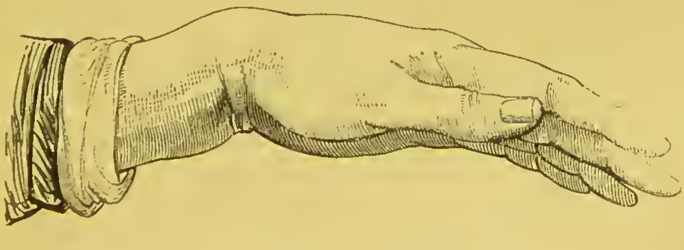
The *motionless condition* of the head of the radius may best be ascertained by the surgeon grasping the upper part of the fore-arm with one hand, having his thumb firmly pressed on the head of the bone, while with the other hand he takes hold of the hand of the patient on the suspected side, and forcibly performs pronation and supination. A motionless condition, under these circumstances, indicates fracture; mobility is a proof of integrity. This is a most useful guide to diagnosis when the fracture is in the upper part; in which case, from the bone being covered by muscles, the other symptoms are more obscure.

Crepitus, which can best be discovered during the above method of examination, is a sure symptom of fracture. It has been called crepitus, or hard crepitus, to distinguish it from a soft crackling sensation sometimes produced by effusion into the soft parts. The absence of crepitus, however, will not prove the non-existence of fracture; for crepitus may be prevented altogether by the presence of muscular fibre between the broken extremities, or it may be rendered not very perceptible, in the first instance, by the effusion of blood, or, at a much later period, by the secretion of lymph.

Diminution of the transverse measurement of the fore-arm, occasioned by the fractured portions falling into the interosseous space. This symptom is most apparent when the fracture is near the middle; it can be increased by pressing the bones near the fracture, or by forcibly bending the hand to the radial side of the fore-arm.

When the fracture is in the upper third, this symptom is not very perceptible. When the fracture is very near the wrist, the fractured portions often occasion such a pressure upon the tendons as to prevent the motions of the fingers; and sometimes the swelling from effusion into their sheaths gives the appearance of a dislocation. The accompanying sketch, from Liston, is very characteristic of fracture near the wrist.

Fig. 44.



4. *Position of the fractured portions.*—If the fracture be near the middle of the bone, the part above the fracture remains in its natural position; the part below is drawn too far backwards or forwards, following the movements of the hand when pronated or supinated, and can only be kept in a line with the upper part when the hand is

midway between pronation and supination; it is also drawn too near the ulna by the pronator quadratus muscle; hence arises the diminution of the interosseous space. When the radius is fractured at its neck, the inferior part is drawn upwards, inwards, and forwards, by the biceps muscle, while the head and fractured neck are drawn slightly outwards by the supinator radii brevis.

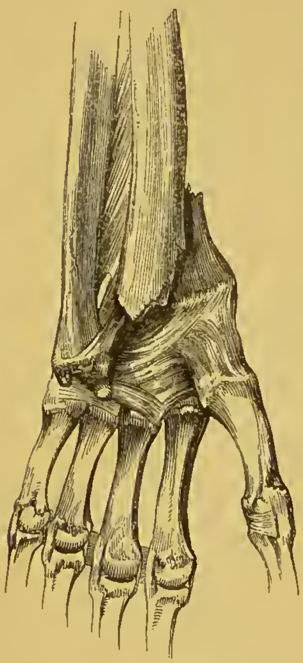
Speaking of fracture of the radius near the wrist, Sir Astley Cooper remarks:—

"If this fracture occurs in a very oblique direction, so great a displacement of the radius ensues, that dislocation of the ulna forwards is also produced.

"I have given a plate of this accident, from a preparation of it in the museum at St. Thomas's Hospital. The lower end of the radius is seen in its natural situation, articulated with the carpal bones. An inch above the ligamentum annulare carpi, the broken extremity of the radius is seen projecting under the flexor tendons of the wrist, which have been removed to show its situation; the ulna is dislocated forwards, and rests upon the os orbiculare.

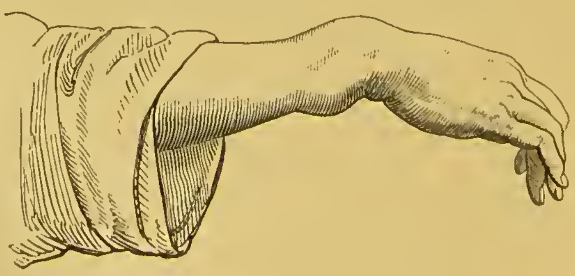
"*Symptoms.*—The signs of this injury are, that the hand is thrown back upon the fore-arm, so as, at first sight, to exhibit the appearance of a dislocation of the hand backwards; and a projection of the ulna is felt under the tendon of the flexor carpi ulnaris muscle, just above the os orbiculare; and thirdly, the fractured extremity of the radius is easily detected, under the flexor tendons of the hand. I have seen this accident frequently, and at first did not exactly understand the nature of the injury; indeed, dissection alone taught me its real character."

Fig. 45.



From Cooper.

Fig 46.



From Cooper.

Fractures of the radius near the wrist present great varieties with regard to direction, symptoms, and state of parts. When transverse, and free from impaction, the displacement is not great, and the parts have the appearance represented in the above sketch from Liston. If the fracture be very oblique, the accident may give rise to the condition of parts described and delineated by Sir Astley Cooper.

There are two fractures of the radius in this situation occasionally attended with impaction. By a fall on the ball of the thumb the radius may be fractured, the lower fragment may be twisted a little outwards, and the under end of the upper fragment may be forcibly sent by the projectile motion into the lower fragment. By a fall on the back of the hand the radius may become the subject of fracture, the under fragment may be sent forward, and the under extremity of the upper fragment may project backwards. As I lately saw in a dissection, it may be impacted in the cancellous structure of the lower fragment.

FRACTURE OF BOTH BONES.

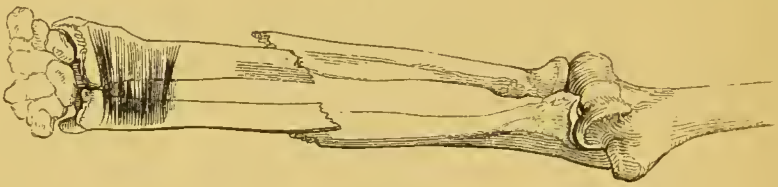
Causes.—Fracture of both bones may be caused by a blow, or by a heavy body passing over the fore-arm,—in which cases the bones are usually fractured in the same situation; or by a fall on the hand, when the radius, which in the first instance receives the whole shock, is fractured, and the ulna, to which the shock is thus transferred, gives way likewise. In the latter case the bones are not necessarily fractured in the same situation.

There is a difference of opinion among surgeons respecting the usual situation of the fractures, when both bones are broken; some supposing that they are generally in the same situation, while Velpeau and others maintain the contrary opinion. In explanation of this difference it may be stated, that the fractures, if produced by violence applied to the hand, will not be in a line, as the weakest part of each bone will give way; but if the fractures be the result of direct violence, they will in all probability be in the same situation.

Symptoms.—The symptoms are,—pain increased on moving the parts, loss of the power of pronation and supination, tumefaction or some unnatural appearance, for the most part an apparent decrease of the diameter of the fore-arm from side to side by the diminution of the interosseous space, and increase of the antero-posterior diameter by the muscles being forced out from between the bones; angular deformity, apparent on raising the fore-arm; mobility in a part which ought to be inflexible; and crepitus, which can generally be made very perceptible by the surgeon giving a rotatory motion to the hand. The interosseous space may be still further diminished by compressing the bones. The fore-arm is generally semi-fixed, and there is but little shortening of the limb.

State of the parts.—The pronator quadratus muscle draws the under parts of the two bones towards each other, and the pronator radii teres draws the part of the radius into which it is inserted towards the ulna; this diminishes the transverse diameter, while the constant pressing out of the muscles from between the bones occasions the increase of the antero-posterior.

Fig. 47.



From LISTON.

The parts of the bones below the fracture can be made to point towards the parts above, only when the hand is in a straight line with the fore-arm, and midway between pronation and supination.

FRACTURE OF THE ULNA.

Three fractures of the ulna are met with, namely, of the shaft, and of the olecranon, and coronoid processes.

Fractures of the processes present peculiar symptoms, and require particular methods of treatment; we shall, therefore, delay the consideration of them, until after the description of the treatment proper for the other fractures of the fore-arm.

FRACTURE OF THE SHAFT OF THE ULNA.

Causes.—This fracture is almost always caused by violence directly applied to the bone, as by a blow or a fall on the inner side of the fore-arm.

Symptoms.—The existence of this fracture can be easily discovered, by drawing the finger along the inner part of the ulna, when, from the superficial situation of the bone, an irregularity caused by the fracture is perceptible. There is a depression at the seat of the fracture, and the part below it is too near the radius.

Crepitation is usually perceptible on moving the under part backwards and forwards; and sometimes the long axis of the hand is not in a line with the long axis of the fore-arm, but is drawn inwards.

State of the parts.—The fracture is generally in the under part of the bone, where it is most slender, and exposed to injury from its superficial situation. The position of the fractured parts is as follows:—The part above the fracture is preserved in its natural situation by its connexion with the humerus, whereas the part below is drawn towards the radius by the pronator quadratus.

IV. TREATMENT OF THE THREE CLASSES OF FRACTURES OF FORE-ARM.

The treatment of all these fractures consists of two parts, the procuring and maintaining coaptation. This is procured by bending the fore-arm at right angles to the arm, and placing the hand midway between pronation and supination; then using slight extension, if necessary, and pushing back the protruded muscles between the bones. To maintain coaptation, we must call in the aid of both attitude and mechanism.

Attitude.—In each class of fractures the fore-arm ought always to be at a right angle with the arm, that the muscles of the arm may be uniformly relaxed; and the hand ought always to be placed midway between pronation and supination, that is, with the thumb upwards and the little finger downwards. If this be neglected, the fractured portions will unite so as to form an angle with each other; and the consequence will be, the loss of the power of supination, if the hand be kept in a state of pronation, or of the power of pronation, if it be supinated. The only variation of attitude in the different classes of fractures is in the relative position of the hand and the long axis of the fore-arm: in fractures of both bones the long axis of the hand should be in a line with the long axis of the fore-arm; in fractures of the radius, the hand should be depressed; and in fractures of the ulna slightly elevated.

The object aimed at in these peculiarities of position is, to prevent the diminution of the interosseous space; which is accomplished, in fracture of both bones, by uniformly extending the muscles connected with the radius and ulna; in fracture of the radius, by extending the muscles attached to the outer side of the radius; and in fracture of the ulna, by the extension of those on the inner part of the bone; and these conditions of the muscles are produced by the above described attitudes of the hand. The following directions exhibit at one view the attitudes to be observed:—

1. Bend the fore-arm at *a right angle* with the arm. 2. Keep the hand midway between pronation and supination. 3. In fractures of both bones, *keep the hand in a line with the long axis of the fore-arm.* 4. In fractures of the radius, *depress the hand.* 5. In fractures of the ulna, *raise the hand.*

Mechanism.—Various appliances have been used to preserve the parts at rest, and in apposition. Some surgeons use pasteboard splints, softened in hot water, and then moulded to the fore-arm; some, splints composed of several parallel pieces of wood secured together by a piece of linen or leather; while others make use of two wooden splints, slightly concave on one side, and convex on the other. Baron Boyer recommends that a small oblong pad should be applied between the concave surface of each splint and the fore-arm, in order more effectually to press in the muscles, and to preserve the interosseous space. But if the splints be applied closely, the pressure in the direction of the antero-posterior diameter will be sufficient; nor will any padding be requisite, except a little cotton to prevent the pressure from irritating the skin. In fracture of a single bone the splints should extend only to the wrist; but when both bones are broken, one of the splints should reach to the fingers, that the hand may be kept in a line with the long axis of the fore-arm;—the longer is usually applied to the front of the fore-arm.

To preserve the mechanism in its proper situation various means have been employed. The common roller and starch bandage are both objectionable, inasmuch as they tend, by pressing the radius and ulna together, to diminish the interosseous space; they also keep up a degree of heat about the part, and create trouble in taking off the splints, which must occasionally be done to ascertain whether the part presents the desired appearance. The loop-bandage is not liable to the same objections; but the most convenient and elegant manner of treating these fractures is, to use the wooden splints, retaining them in a proper position by the buckle-bandage. Two or three may be used, and the fore-arm should be kept in a sling.

DIRECTIONS AS TO MECHANISM.

1. In fractures of one bone, apply two splints of equal length, not extending beyond the wrist.
2. In fractures of both bones, use two splints of unequal length, the larger being applied to the front of the fore-arm, and reaching to the ends of the fingers; the other need not be extended beyond the wrist.

The objects aimed at by treatment in these fractures are, to obtain coaptation, to preserve the interosseous space, and to keep the parts at rest in a proper position. For the attainment of these ends, attitude and mechanism are both necessary; the former should be used from the very beginning of treatment; but the application of mechanism should be delayed until either the danger of inflammation supervening is over, or the inflammation, if it has already taken place, has been subdued.

The pistol-shaped splint, introduced by Nelaton, will be found a very convenient apparatus for the treatment of fractures of the radius near the wrist.

FRACTURE OF THE OLECRANON PROCESS.

Causes.—This, which is by no means an uncommon fracture, is usually caused by a blow or a fall on the elbow, and sometimes, although very rarely, by violent contraction of the triceps extensor cubiti muscle.

Varieties.—This fracture may be, in direction, either transverse or oblique, and in situation, at the base, middle, or apex of the process.

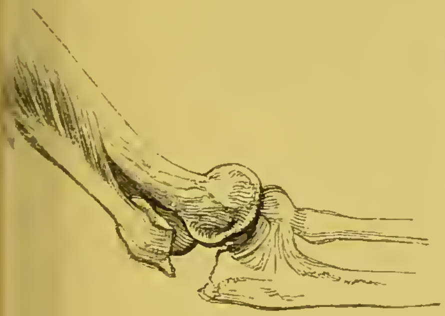
Transverse fracture in the middle of the process is the most frequent, both as to situation and direction.

Symptoms.—An unnatural hard swelling, caused by the olecranon, in the under and back part of the humerus, sometimes half an inch above the joint, and sometimes two inches from the part from which it is broken off; the distance is increased by bending the fore-arm, or by a voluntary effort on the part of the patient to accomplish extension of the joint. This swelling can easily be moved from side to side, but it cannot be pressed downwards without difficulty, especially if the extremity be in such a position as to keep the triceps on the stretch.

Bulging of the triceps above the hard tumour is a good diagnostic symptom.

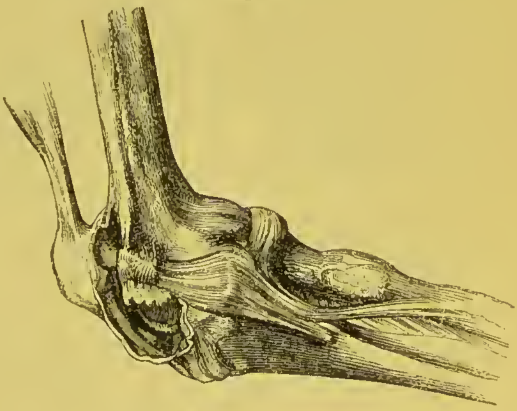
An interspace on the back part of the joint between the olecranon, and the extremity of the ulna; this space is increased by a voluntary effort on the part of the patient to extend the elbow, which merely draws up the broken fragment, or by the surgeon taking hold of the fore-arm and bending it; and it is diminished by extending the fore-arm. The surgeon, on pressing his finger into the interspace, feels as if it were sinking into the joint.

Fig. 48.



From Liston.

Fig. 49.



From Cooper.

Loss of the power of extending the limb is another symptom; and the voluntary effort to do so causes pain, and merely draws up the olecranon. In some cases the power of extension is not entirely lost. This can only happen when the expansion of the triceps is not so completely destroyed as to disconnect the process from the rest of the bone. Earle has recorded a case in which the loss of extension did not take place until the sixth day, when it was sudden, and attended with sudden flexion of the fore-arm.

Crepitus may be discerned, if the extremity be very violently extended, and the parts pressed together with considerable force; but attempts to do this occasion great pain.

The fore-arm is usually half-bent, and there is often great swelling about the joint, from increased secretion of synovia, and frequently ecchymosis to a considerable extent; but these two last symptoms will vary according to the degree of violence by which the accident was occasioned.

Mode of Union.—Reunion in this fracture is almost always by a ligamentous substance, the length of which varies according to the distance of the broken parts from each other. It is very desirable to have it as short as possible, because, in proportion to its length, the arm will be weakened. When the interspace is short, the ligamentous substance is firm, strong, and short; but if it be long, there may be openings through it, so that the reunion will be kept up by ligamentous cords. On account of the difficulty of preserving the parts in apposition, no other than a ligamentous union is generally to be expected. In some cases, however, when the fracture had happened very near to the shaft of the ulna, Sir Astley Cooper has known the union to take place in the living subject by bone; but it is so rare an occurrence that it is scarcely to be hoped for. It seems evident from the following experiments, made by Sir Astley Cooper, that the difficulty of preserving the parts in apposition, is the obstacle to osseous union. "The integuments having been drawn laterally and firmly over the end of the olecranon in a dog, I made a small incision, and placed a knife, on the middle of that process, in a transverse direction; on striking it with a mallet, the bone was readily cut through, a separation directly took place by the action of the triceps muscle, adhesive matter was effused, and, when I examined the limb about a month after, I found the bone united by a strong ligament. I broke the olecranon in the same way in several rabbits; blood was, in these experiments, first thrown out, and then adhesive matter filled up the space of separation, which subsequently became ligamentous, and gradually firmer and firmer, as the time was protracted between the experiment and the time of the examination. As I found the ligament was formed in each of these experiments, I was anxious to learn whether the olecranon could be made to unite by bone, if a longitudinal fracture were produced with but slight obliquity, so that the broken portions might still remain in contact; and I found that, under these circumstances, the osseous union speedily took place. Therefore this bone, like the extremity of the os calcis, when it is broken off, is detached by the action of the muscles, and ligamentous union ensues from want of adaptation."

Treatment.—The principal indications in the treatment are—

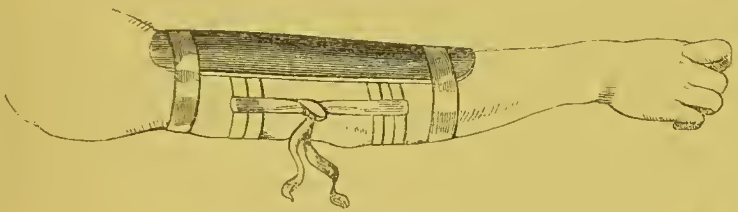
First. If there be much inflammation and irritation at first, to delay all mechanical applications, until they are subdued by leeches, evaporating lotions, purgatives, and other remedies, which should be employed with activity proportioned to the violence of the symptoms.

Secondly. To maintain the fractured surfaces as close together as possible by the judicious position of the limb, and the absolute inaction of the triceps muscle aided by mechanical appliances.

The extremity must be kept very much extended, and for some time this can best be done by keeping the patient in bed. It is necessary not only to keep the fore-arm extended, but also to bring back the arm, that the shaft of the ulna may be brought as near as possible to the attachments of the triceps, both to the humerus and scapula, so that the least obstacle may be offered by that muscle to the bringing down of the olecranon.

Sir Astley Cooper recommends that the parts be kept in apposition, by placing tape or slips of linen longitudinally on each side of the joint, and applying over these a roller round the arm, immediately above and below the fracture only, and then tying the ends of the slips above the fracture to those below, so that the rollers under which they pass are brought nearer to each other, and the detached fragments may be thus kept in the desired position.

Fig. 50.



From Cooper.

Thirdly. To preserve the joint at perfect rest; and for that purpose a straight splint should be applied in front, and retained by a suitable bandage.

Fourthly. To begin passive motion of the joint in the course of a month, for which purpose the splint is to be removed; but as there is great danger of weakening and lengthening the newly formed bone of union, all attempts at motion must be made with the greatest care.

The above plan of treatment, in which the extended position and straight splint are employed, is that which is recommended by Sir Astley Cooper, and practised by most British surgeons; but it is objected to by Desault, Camper, and others, who recommend that the fore-arm should be kept about midway between semi-flexion and complete extension, and that this position should be preserved by means of an angular splint.

Desault and Camper, the advocates of this method, give the folowing reasons for preferring it to that usually practised by British surgeons :—

First. The method which they recommend will bring the fractured parts more in a line with each other. The brachialis anticus in its way from the sides of the deltoid impression to the coronoid process passes over the eminence formed by the lower extremity of the humerus; and they say that the muscle, being put violently on the stretch, will draw forward the ulna, if the olecranon be fractured near its base, and, consequently, the ulna and the broken fragment will not be in a line with each other, the shaft of the bone being brought too far forward. This objection does not apply to the method recommended by the French.

Secondly. They also state that in the attitude recommended by the British surgeons, the broken parts can only be made to touch each other posteriorly, so that they form a retiring angle opening into the joint, into which, therefore, the substance effused for uniting the fractured portions will be thrown, and thus the future movements of the joint be permanently impeded; whereas, in the attitude of Desault, the two portions will meet in front, and form a retiring angle directed backwards, and thus the future movements of the joint will be unaffected by the new formation.

FRACTURE OF THE CORONOID PROCESS.

Causes.—This is a rare accident, but two cases are recorded by Sir Astley Cooper, and one by Mr. Liston. Of the two recorded by Sir Astley, one was that of a gentleman, who fell on his hand while the arm was extended. The coronoid process being driven against the humerus received the shock, and gave way. The other was that of a subject brought to the dissecting room at St. Thomas's Hospital, but of which the cause was unknown. The case mentioned by Mr. Liston, was that of a boy eight years of age, and the fracture was occasioned by his hanging for a long time by his hands, from the top of a high wall, being afraid to drop down.

Symptoms.—The fore-arm is extended, and the ulna projects backwards; but when the fore-arm is bent and brought forward, which is easily done, the deformity disappears; the limb, however, again becomes extended, and the deformity returns, when the force employed to bend and bring forward the part is removed. The isolated process is felt in front of the joint, or higher up, according to the state of contraction of the brachialis muscle inserted into it.

Treatment.—The objects to be aimed at by treatment are,—to relax the brachialis anticus muscle, to preserve the parts at rest, and to keep the isolated fragment as much as possible in apposition with the part from which it has been detached. These objects may be best attained, by keeping the fore-arm very much bent, and applying angular wooden splints, very well padded, or pasteboard splints moistened in hot water, and moulded to the elbow.

This treatment should be continued for about a month, and passive motion should then be employed; but this must be done with the greatest caution, lest the ligamentous substance, which re-unites the parts, should become lengthened and weakened.

FRACTURES OF THE HUMERUS.

These injuries, according to Mr. Lonsdale, form about one-sixteenth of all fractures, so that they occur less frequently than the corresponding injuries of some of the other bones. Of one hundred and eighteen cases of fracture of the humerus, mentioned by Mr. Lonsdale, eighty-nine were of the shaft, sixteen of the condyles, and thirteen of the surgical neck.

That the description of the different fractures of this bone may be more distinct, it will be convenient to arrange them in the following classes:—1. Transverse fracture of both condyles. 2. Oblique fracture of either condyle. 3. Fracture of the under third of the haft. 4. Fracture of the middle of the humerus. 5. Fracture below he insertions of the three muscles into the margins of the bicipital groove. 6. Fracture above the insertions of the three muscles into he margins of the bicipital groove, or, as it is called, fracture of the urgical neck of the humerus, a name given to all that part between he insertions of these three muscles and the tuberosities. 7. Fracure of the anatomical neck of the bone.

The bone may be broken in any part of its length, but all its fracures may be included in one or other of the above-named classes.

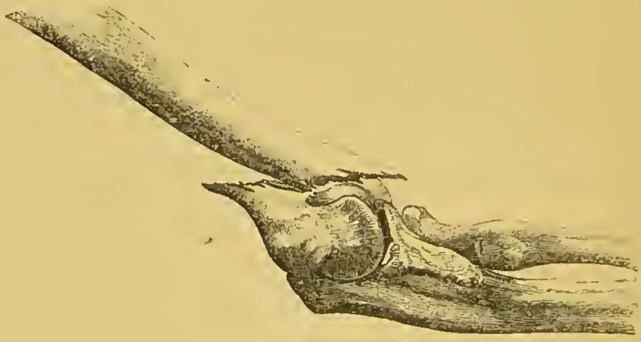
1. TRANSVERSE FRACTURE OF BOTH CONDYLES.

Symptoms.—The symptoms of this fracture are, an unnatural prominence behind the joint; immediately above this, an unnatural fossa r depression; and preternatural shortening of the front of the forerm. These three symptoms are common to this fracture and dislo-ation backwards of the radius and ulna; but there is in fracture, he following sure diagnostic guide;—if the arm be fixed, and the forerm be drawn in the line of displacement, the symptoms disappear; but they return, as soon as the extending force is removed; if the rm be fixed, and the fore-arm pressed backwards and forwards, or if it be rotated, crepitation may be perceived; and, if the arm be aised, and the fore-arm forcibly depressed, an angular deformity will e observed.

Desault and others mention frequent cases of this fracture, in which he condyles were not only broken off by a transverse fracture from he rest of the humerus, but also separated from each other by a ertical fissure. In these instances, we have in addition to the before-amed symptoms, a still greater mobility of the parts, increased deformity, the bulging out of the joint laterally augmented by pressing in the direction of the longitudinal fissure.

State of the fractured portions.—In simple transverse fracture, the condyles are drawn backwards; in transverse fracture of both condyles with a longitudinal fissure between them, they are drawn backwards, and very slightly separated from each other. In this latter case the humerus is separated into three pieces.

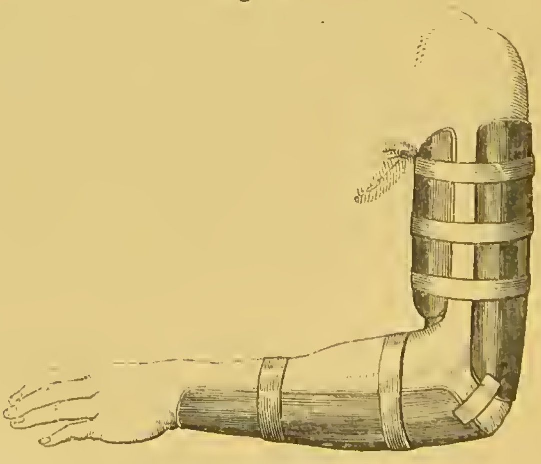
Fig. 51.



From Cooper.

Treatment.—Bend the fore-arm at a right angle to the arm, draw it forward until the parts be brought into their proper places and into apposition, and preserve them in this condition by applying a few turns of a roller round the lower part of the arm and the upper part of the fore-arm, and by employing two wooden splints,—one, straight, to be placed in front of the humerus, the other composed of two parts at a right angle with each other, the upper part to be placed behind the humerus, and the lower part below the fore-arm; both splints to be retained by buckle bandages. Evaporating lotions should be applied, and the extremity kept in a sling.

Fig. 52.



From Cooper.

The above is the treatment recommended by Sir Astley Cooper; and it should be continued in the case of an adult for about a month, and in that of a younger patient for nearly three weeks, after which time passive motion should be tried, that the joint may recover its power of moving.

I have treated this fracture very successfully by means of Weiss's splint, which is a most convenient apparatus for the purpose, inasmuch as it admits of the elbow being slightly moved when that is thought to be judicious, without the necessity of taking off the splint.

Desault has recommended two angular splints with joints, and some Italian surgeons apply two angular splints, the one before and the other behind the joint. If the condyles be separated, care must be taken to keep up lateral pressure.

Although in some instances this injury is so seriously complicated with laceration and contusion as to make it necessary to remove the limb, yet, from the small size of the joint and the accessible situation of all the parts with regard to surgical treatment, it is—except in cases of extreme complication and disorganization—comparatively safe in its results, and amputation is unnecessary.

2. OBLIQUE FRACTURE OF EITHER CONDYLE.

Before describing this fracture of the condyles, it may be proper to state, that modern anatomists have named the articulatory surfaces at the lower part of the humerus the trochlea, and condyle; the former being the inner, the latter the outer articulatory surface; whilst the prominences beyond, or the eminences of attachment for the muscles, are named the epicondyle and the epitrochlea. The old nomenclature, however, is that followed by surgeons, namely, external and internal condyle, each condyle furnishing an articulatory surface and an eminence of attachment for muscles.

Fracture of either condyle may be either slight, as when the eminence of attachment only is broken off; or extensive, as when the articulatory surface is detached.

FRACTURE OF THE INTERNAL CONDYLE.

Symptoms.—When the fracture detaches but a small portion, the symptoms are a slight unnatural prominence, with crepitation and mobility, perceptible on grasping the part and bending the fore-arm backwards and forwards.

When the fracture is extensive, the fore-arm is bent, and the hand drawn a little inwards, and inclined to pronation; when the fore-arm is extended, the broken condyle projects backwarks, and with it the ulna, occasioning the appearance of dislocation of the ulna, which, however, resumes its natural position when the fore-arm is bent. Additional symptoms are, mobility, crepitus, and pain on grasping the condyles and bending and extending the fore-arm; and slight projection forward of the condyle in front of the ulna, if it be very violently extended.

The nature of the displacement must be evident from what has been already stated.

FRACTURE OF THE EXTERNAL CONDYLE.

Symptoms.—When the fracture is slight, the symptoms are,—some degree of swelling about the external condyle, attended with pain; crepitation, and mobility perceptible on grasping the condyles and performing pronation and supination of the hand.

When the fracture is extensive, in addition to the above symptoms, the condyle is a little drawn backwards, and the radius with it; the fore-arm is slightly bent; and the hand is drawn outwards and inclined to supination.

Treatment of Slight and Extensive Fracture of each Condyle.—1. In both fractures of each condyle, preserve the fore-arm at a right angle with the arm. 2. In extensive fracture of each condyle, apply a few turns of a roller round the joint, and then a wooden splint, the parts of which are at a right angle with each other, placing one part behind the humerus and the other below the fore-arm, and retain it by buckle bandages. 3. In slight fractures of each condyle mould pasteboard splints to the joint, and retain them by a few turns of a roller or buckle bandages. 4. In both fractures of the internal condyle pronate the hand and bend the fingers. 5. In both fractures of the external condyle supinate the hand and extend the fingers.

3. FRACTURE OF THE UNDER THIRD OF THE SHAFT OF THE HUMERUS.

Symptoms.—Fracture in this situation is easily detected by inability on the part of the patient to raise the arm; by unnatural mobility at a part, which in the sound state is inflexible; by angular deformity on taking hold of the upper part of the humerus, and raising the arm; and by crepitation on grasping the bone above and below the fracture, and moving the parts on each other.

Relation of the fractured portions.—In this situation there is little or no tendency to displacement, the parts above and below the fracture being equally embraced by the triceps behind and the brachialis anticus before. In fact, there is no tendency to displacement backwards, forwards, or to either side, and seldom any in a longitudinal direction, unless the fracture be very oblique, when, as the resistance offered by the bone to the contraction of the muscles is removed, there is a tendency to shortening of the arm.

Treatment.—This fracture is treated by applying two wooden splints, the one before, the other behind the humerus, and retaining them by means of buckle bandages, at the same time keeping the extremity in a sling, which should not be so short as to press up the elbow, but merely to support the weight of the limb. If the elbow should be pressed up owing to the shortness of the sling, and if the fracture should be oblique, the pressing of the fractured parts against each other may cause a shortening of the arm.

4. FRACTURE OF THE MIDDLE OF THE HUMERUS.

Symptoms.—The same as in the preceding injury.

Nature of Displacement.—The displacement is rather more than in the fracture of the under third, the part below the fracture having a tendency to be drawn a little outwards.

Treatment.—The same as in the preceding injury, except that the splints should be applied to the outer and inner sides of the arm. Some surgeons employ four splints in this fracture—one to the outside, one to the inside, one to the back, and one to the front of the arm.

5. FRACTURE BELOW THE INSERTIONS OF THE THREE MUSCLES AND ABOVE THE INSERTION OF THE DELTOID.

Symptoms.—In addition to the symptoms exhibited by the two preceding injuries — mobility at a part naturally inflexible, inability to raise the extremity, crepitation, and angular deformity on raising the upper part of the humerus—this fracture has two symptoms peculiar to itself, namely, an unnatural swelling on the outside of the arm below, and another on the inner side above the fracture. These swellings are explained by the nature of the displacement.

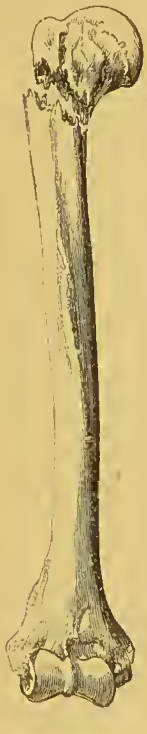
Nature of Displacement.—The muscles which cause displacement are four, namely, three inserted into the margins of the bicipital groove, the pectoralis major, latissimus dorsi, and teres major, which draw the upper part inwards, and the deltoid inserted below the fracture, which draws the lower part outwards, and, if the fracture be oblique, upwards :—in this case there will be slight shortening of the fore-arm in addition to the other symptoms.

Treatment.—The first object of treatment is to obtain coaptation, which is easily effected by extension and counter-extension ; then to preserve the extremity in the proper attitude, that is, with the arm by the side and the fore-arm at a right angle with the arm ; and to keep the parts at rest and in apposition. Desault's apparatus for preserving the extremity at rest in the proper attitude, and maintaining apposition, consists of two long rollers—a wedge-shaped pad which will extend the whole length of the arm,—three splints, two of which should be the length of the humerus, the third shorter, and a sling, not too short, otherwise it will, especially if the fracture be oblique, produce displacement of the fractured portions by raising the elbow and fore-arm too high.

A simple and successful mode of treatment is, after obtaining coaptation and placing the extremity in the proper position, to apply four splints, one to the inner side, one to the outer; one to the front and one to the back of the arm; and to retain them by means of buckle bandages; then, after placing between the arm and chest a pyramidal pad with its base upwards, to bandage the arm and chest together, being careful to make the bandage loose above and tight below the fracture; and, lastly, to support the fore-arm by a sling, which must not be too short, for the reasons before stated.

6. FRACTURE ABOVE THE INSERTIONS OF THE THREE MUSCLES INTO THE BICIPITAL GROOVE, AND BELOW THE TUBEROSITIES; OR, AS IT IS OFTEN CALLED, FRACTURE OF THE SURGICAL NECK.

Fig. 53.



From Cooper.

Symptoms.—The symptoms differ from those of the last described injury only in this, that the unnatural swelling on the outside of the arm is above the fracture, and that on the inner side below it.

Nature of Displacement.—This is the very opposite of what is observed in the former injury; the part above the fracture is drawn outwards by the three muscles inserted into the greater tuberosity, namely, the supra spinatus, the infra spinatus, and the teres minor; and the part below is drawn inwards by the three muscles inserted into the borders of the bicipital groove, namely, the pectoralis major, the latissimus dorsi, and the teres major.

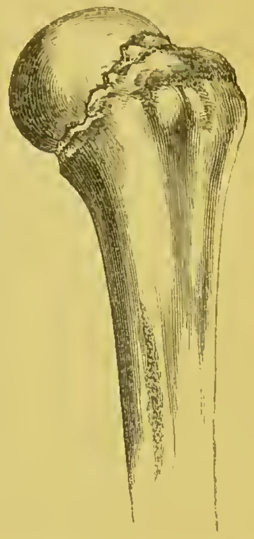
Treatment.—The treatment differs from that of the former fracture in only two respects:—the apex of the pyramidal pad should be upwards; and the roller which is put round the arm and chest to bandage them together, should be applied loosely below the fracture, that the lower fragment may not be drawn inwards, and very firmly above, to prevent the upper fragment from being drawn outwards.

7. FRACTURE OF THE ANATOMICAL NECK, OR BETWEEN THE BALL AND TUBEROSITIES.

The possibility of fracture in this situation is no longer a matter of doubt. Bichat saw, in the possession of Larbard, the humerus of a young man, seventeen years of age, the ball of which was broken off from the rest of the bone. Delpech records an instance proved by dissection. Professor Samuel Cooper refers to the case of a boy shown to him with a fracture of the neck, and Sir Astley Cooper's work contains several interesting cases. I have in my museum an interesting specimen of this comparatively rare fracture.

The injury is almost always caused by direct violence. It is most frequently met with in youth, sometimes in old age, but very rarely in the middle period of life. Sir Astley Cooper's work contains the description of a case in an old person, in which the existence of the fracture was proved by dissection.

Fig. 54.



United fracture of anatomical neck of Humerus. From a preparation in my museum.

Symptoms. — Acute pain is experienced, and sometimes at the moment of the accident a sound is heard as of something breaking. There is sudden inability to move the limb, which lies powerless by the side, though it yields in the freest manner to any motion communicated to it. When the limb is moved, crepitation is generally very perceptible, but every movement creates great pain. On examining the shoulder near the outer part of the coracoid process, a projection of bone is usually felt, which disappears on extending the arm, but returns when the extending force is renewed; and immediately below the acromion process it is observed that there is no vacuity, in consequence of the ball remaining in the glenoid cavity. This is a diagnostic symptom between fracture of the neck of the humerus and dislocation of the shoulder. There may be a flatness of the arm on the outer side farther down, occasioned by the drawing in of a part of the deltoid by the upper extremity of the portion of bone below the fracture. If there be not very great swelling, it may be possible to feel the ball motionless in rotating the arm.

Nature of Displacement.—The ball remains in the glenoid cavity, and the shaft is drawn forwards and upwards to the front and outer side of the coracoid process.

Treatment.—On this subject Sir Astley Cooper says, "The best mode of treating these accidents consists, in the young, in applying a splint on the fore and back part of the arm, binding it on by a roller, placing a pad in the axilla, and using a clavicular bandage, supporting the hand, but not the elbow, in a sling, since, if the elbow be raised, the broken end of the bone is pressed forwards. In old persons the injury is more severe, and the force producing it is violent; it therefore becomes necessary to reduce inflammation, and to apply leeches and evaporating lotions, to observe perfect rest at first, and after some time the same treatment as to bandages may be pursued as in the young. In both the old and the young, passive motion is to be employed so soon as the union is effected, which in youth is in a month, but it requires from two months to twenty weeks in old age. In all fractures about the upper part of the arm and shoulder, it is judicious to support the vessels of the hand and fore-arm by a bandage. If this precaution be neglected, the pressure on the axillary and cephalic veins will be apt to produce engorgement of the more distant parts, for the removal of which it is sometimes necessary to take off for a time all retentive apparatus, and to confine the patient to the recumbent posture."

FRACTURE OF THE SCAPULA.

The comparative frequency of fractures of the scapula is thus stated by Mr. Lonsdale. Out of one thousand nine hundred and one cases of fractures generally, eighteen were of the scapula, and of these eight were of the acromion process, eight of the body, and two of the cervix.

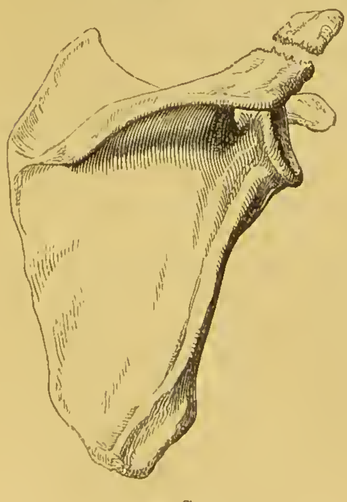
Fractures of the scapula may be divided into five classes :—fractures of the acromion process—of the inferior angle—of the body—of the coracoid process—and of the cervix.

The first two classes are of most frequent occurrence. The body of the bone from its depth, covered position, and mobility, is by no means very liable to fracture, and the coracoid process and cervix are very seldom broken ; hence Boyer remarks, they generally require great violence to break them, and then the contusion of the soft parts is a worse injury than the fracture ; for example, he has seen the coracoid process broken by the blow of the pole of a carriage, and the patient lose his life by the violence inflicted on the soft parts about the shoulder.

FRACTURE OF THE ACROMION.

Symptoms.—The patient feels as if the shoulder were falling down, complains of a great sense of weight, and has little power to raise the arm. On tracing the spine from its base to the acromion process, it is observed that the part between the fracture and the clavicle is depressed, from being drawn down by the weight of the extremity, and the contraction of the deltoid muscle. The roundness of the shoulder is lost ; the ball of the humerus falls as far down into the axilla as the capsular ligament will permit ; and the measurement from the sternal end of the clavicle to the extremity of the injured shoulder, compared with the sound side, will be found to be diminished. On placing one hand over the acromion, and pressing up and rotating the humerus with the other, crepitation will be perceptible. When the humerus is raised,

Fig. 55.



From Cooper.

the deformity of the shoulder disappears; but it returns when the arm is allowed to fall down.

Nature of Displacement.—The scapula and the remaining portion of the acromion are drawn upwards and a little backwards by the trapezius and levator scapulæ; while the fractured part is drawn downwards and a little forwards by the weight of the extremity and the deltoid muscle.

Treatment.—The objects to be attained in this case are,—

First. To raise the broken fragment, and keep it in its proper position. This can best be done by raising the elbow, and keeping it raised by a short sling; the ball of the humerus is thus pressed up, and made to act as a splint in keeping the fractured parts in apposition.

Secondly. To relax the deltoid muscle. This is best effected by placing a cushion between the elbow and the side.

Thirdly. To keep the arm at rest in rather a backward position. This is easily done by bandaging it to the chest with a roller.

Fourthly. To exert some pressure over the acromion, by which close coaptation may be secured; and this may be effected by a few turns of the roller with which the arm is bandaged to the chest.

It is quite possible to treat this fracture in a satisfactory manner by means of a cushion and a single roller, the latter being applied so as to bandage the arm to the chest, to raise the elbow, and also to exert pressure over the acromion. Mr. Liston proposes the same simple apparatus as he recommends in fracture of the clavicle, which shall be described in treating of the fractures of that bone.

FRACTURE OF THE INFERIOR ANGLE.

Symptoms.—In this injury the detached angle can for the most part be felt to be too far forwards; but the most diagnostic mark is, that it remains stationary, if motion be communicated to the scapula; or, if the angle be moved, the scapula is unaffected by that motion.

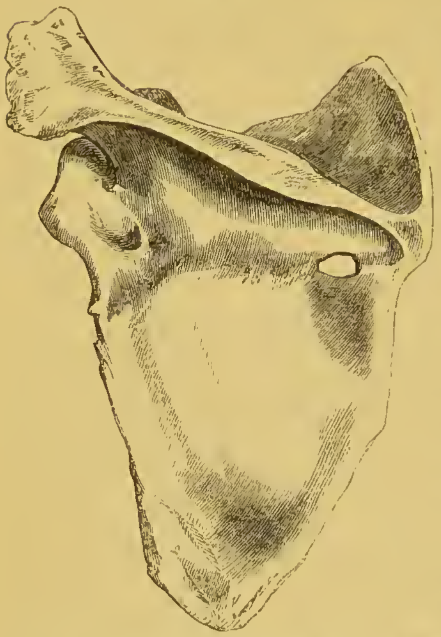
Nature of Displacement.—The body of the scapula remains in its natural situation, and the inferior angle is drawn forward,—a displacement caused, if the fracture be very near the angle, by the fibres of the serratus magnus; and if it be higher up, by the same fibres and the teres major and latissimus dorsi muscles.

Treatment.—The angle is too small to be easily kept back, and coaptation is attempted by bringing the scapula forwards and downwards, and by keeping it in that position. The arm is pressed downwards, forwards, and inwards, and in that situation bandaged to the chest, while by means of the roller by which the arm is secured, and one compress behind the body of the scapula for pressing it forwards, and another before the angle for keeping it backwards, the parts are maintained in apposition and at rest.

FRACTURE OF THE BODY OF THE SCAPULA.

The fractures in this situation may be either transverse or longitudinal; the latter, which is the less frequent, can generally be distinguished by crepitus, to which will be added, in transverse fractures, an irregularity of the posterior costa of the bone.

Fig. 56.



Union of fracture of body of Scapula. From a preparation in my museum.

There is little tendency to displacement, because all the parts surrounding the fracture are embraced by muscles, both on the outer and inner aspects of the bone; and all that is necessary in the way of treatment is to keep the arm in a sling, and the scapula forward by a few turns of a roller round the chest. If the fracture be completely transverse, then the under parts will be drawn forwards, and the same treatment will be required as for fracture of the angle.

FRACTURE OF THE CORACOID PROCESS.

The distinctive characters of this injury are,—pain, which is increased by stretching back the arm, or by any voluntary effort to raise it; and mobility of the coracoid process when the scapula is rendered immovable. This unnatural mobility is very perceptible on fixing the scapula, and moving the arm backwards and forwards. When the arm hangs by the side, the apex of the coracoid process can be felt lower than on the sound side. The fracture is easily discoverable.

Nature of Displacement.—The scapula remains in its natural position, but the coracoid process is drawn downwards by the coraco-brachialis, and biceps muscles, and downwards and inwards by the pectoralis minor.

Treatment.—The great object is to relax the coraco-brachialis, biceps, and pectoralis minor muscle, so as not to keep up the displacement. For this purpose the fore-arm should be bent on the arm, and the arm placed across the chest, and the scapula pressed downwards and forwards; the parts being maintained in that position by bandages. Gentle compression with a pad placed below the coracoid process is also useful for keeping the fragment in a proper position. Another important part of treatment is to keep the patient for some time in bed, with the shoulders bent downwards and forwards by means of pillows.

There seems to be no reasonable prospect of osseous reunion. The new connexion is formed by a ligamentous substance.

FRACTURE OF THE NECK OF THE SCAPULA.

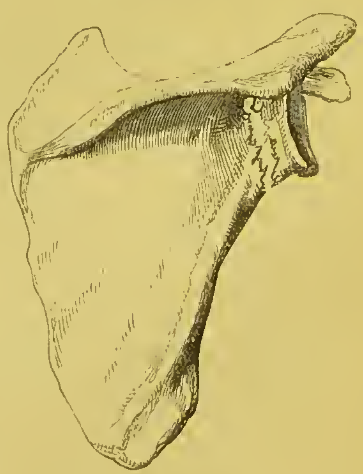
By this injury is not to be understood fracture of the anatomical neck of the scapula, which is situated beyond the glenoid cavity, and before the coracoid process, but fracture of what has been called the surgical neck; that is, the narrow part of the bone, into the formation of a part of which the semilunar notch enters, and which is behind the root of the coracoid process.

In this fracture the glenoid cavity and the coracoid process are both broken off from the rest of the bone.

This is, comparatively, a very rare injury; so that some excellent authorities have doubted the possibility of its taking place as the result of direct violence; but its occurrence has now been proved by dissection. I have seen three examples of this fracture. One was in a woman upwards of forty-five years of age; another, in a man upwards of fifty; and a third, in a lad of sixteen. They were all caused by falls on the upper and back part of the shoulder. That in the case of the lad happened in consequence of falling over a steep embankment. The symptoms were exceedingly well marked, and all the patients became perfectly well: but in the case of the female this did not take place until the lapse of four months.

Symptoms.—The signs of this injury are—flattening and falling down of the shoulder; an unnatural depression under the acromion, and an unnatural tumour in the axilla caused by the head of the humerus; symptoms which can all be made to disappear, by pressing up the arm, but which return as soon as the support to the arm is removed. The same appearances are presented in dislocation downwards of the humerus; but the fracture is easily distinguished by observing with what facility the arm can be raised, and the symptoms made to disappear, and how immediately they return when the arm is left to itself. Besides these peculiarities, which are not found in dislocation, there is another symptom which clearly indicates fracture, namely, crepitation. Sir Astley Cooper remarks, that the best method of discovering the crepitus is, for the surgeon's hand to be placed on the top

Fig. 57.

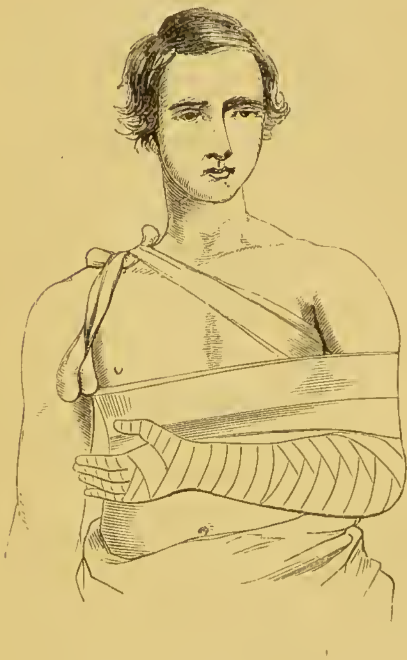


From Cooper.

of the shoulder, and the point of the fore-finger rested on the coracoid process; the arm being then rotated, the crepitus is directly perceived, because the coracoid process being attached to the glenoid cavity, and being broken off with it, though it remains itself uninjured, the crepitus is communicated through the medium of that process.

Nature of Displacement.—The body of the bone remains in its natural position, and the broken fragment is drawn downwards and inwards by the weight of the extremity.

Fig. 58.



Treatment.—In the treatment of this fracture, three things are to be done; first, the head of the humerus is to be kept outwards; secondly, the glenoid cavity and the neck of the scapula are to be raised by elevating the humerus; and thirdly, the parts are to be kept at rest. The appliances necessary for these purposes are,—a pad in the axilla for keeping out the head of the humerus; a short sling for maintaining the arm in a raised position; and a roller to preserve the parts at rest by bandaging the arm to the chest.

In the adult, the time required for recovery from this accident is about three months.

FRACTURE OF THE CLAVICLE.

The clavicle being unprotected by soft parts, and unsupported in its middle, being of considerable length in comparison with its thickness, and from its position between the scapula and sternum having to sustain any shock received on the shoulder, or on the glenoid cavity of the scapula—as when a person falls on the hand with the arm extended—is very liable to fracture. According to Mr. Lonsdale, of all fractures that occur in the vicinity of the Middlesex Hospital, one-seventh are fractures of the clavicle.

Causes.—This fracture may be occasioned by direct violence, as by a blow; or by striking against a hard substance in a fall; or by indirect violence, or counter-stroke, as by a fall on the point of the shoulder, when the clavicle has to sustain the force of the shock, or by a fall on the elbow or hand, when the extremity is extended.

Situation of Fracture.—The fracture, if caused by directly concentrated force, may be at any part of the bone to which the force is applied; but it may be stated as a general rule, that fractures take place most frequently in the middle of the bone, and in the scapular more frequently than in the sternal extremity.

For facilitating the description of fractures of the clavicle, it will be convenient to divide them into those on the scapular and those on the sternal side of the attachment of the coraco-clavicular ligaments to the outer tubercle of the bone.

FRACTURE ON THE SCAPULAR SIDE OF THE CORACO-CLAVICULAR LIGAMENTS.

Symptoms.—On very careful examination it will generally be found, that the part of the bone on the outer side of the fracture is drawn very slightly downwards. This symptom, never very perceptible in this fracture, can sometimes scarcely be discovered; but it will be made more obvious by pulling down the arm, and on pressing the arm upwards the fragment will be replaced, so as to be on a line with the rest of the clavicle. On placing one hand over the fracture, and with the other alternately elevating and depressing the shoulder, crepitus will be perceived. Sometimes the parts remain so nearly in their natural position, that the usual motions of the arm can still be performed.

Nature of Displacement.—There is very little displacement, the part on the outer side of the fracture being retained in its position by its attachment to the acromion process by the acromio-clavicular ligaments, and the part on the inner side by the coraco-clavicular ligaments. This connexion of the parts on each side of the fracture with the processes of the scapula prevents any further displacement than a very slight depression of the outer fragment, occasioned by the weight of the extremity.

Treatment.—If there be no displacement, all that is necessary in the way of treatment is, to preserve the parts at rest by keeping the extremity supported by a sling, and the arm bandaged to the side. If there be displacement, the same treatment will answer, as for the fracture next to be described, excepting that the pad in the axilla should be very small, the fragment not having the same tendency, as in the next case, to fall towards the chest.

FRACTURE ON THE STERNAL SIDE OF THE CORACO-CLAVICULAR LIGAMENTS.

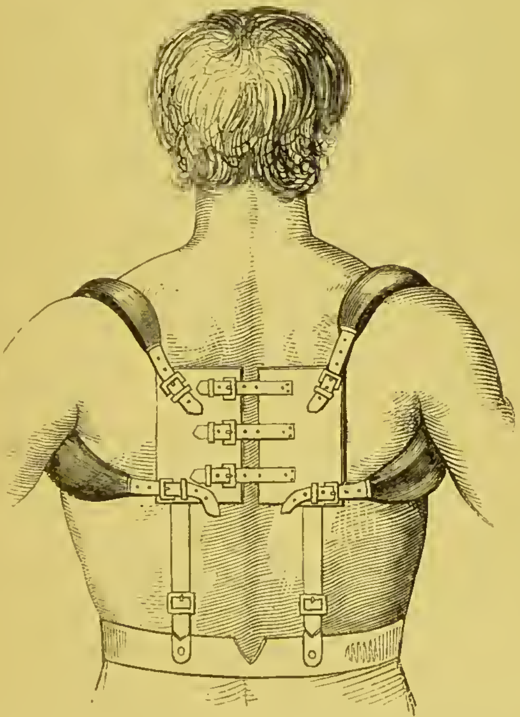
Symptoms.—The broken clavicle being no longer able to sustain the weight of the extremity, or to keep off the scapula from the chest, the arm falls down, drawing with it the part on the scapular side of the fracture, and thus occasions an unnatural depression, which, together with the prominence caused by the sternal end remaining in its natural situation, clearly points out the nature of the injury. The scapula being no longer kept back by the broken clavicle, the shoulder and arm fall inwards and forwards, rendering the distance between the sternal end of the clavicle and the apex of the shoulder less on the affected than on the sound side, and the arm is drawn forward towards the breast. By pressing the head of the humerus very forcibly upwards and outwards, the symptoms may be made to disappear, but they immediately return when the force is removed. The patient inclines the head and neck to the shoulder, and takes off the weight from the broken clavicle when standing, by supporting the elbow with the opposite hand; and when sitting, by resting the elbow on the knee. He is unable to raise the hand to his head, in consequence of the humerus no longer having a fixed point of support. There is swelling from extravasated blood over the bone, and crepitation may be perceived by raising the arm and carrying it backwards, so as to bring the fractured surfaces in contact; but attempts to discover this symptom occasion great pain.

Nature of Displacement.—The part on the sternal side of the fracture, though it appears to be drawn upwards from the falling down of the remaining portion, is in its natural situation, being retained there by the power of the sternocleido-mastoideus muscle above, and of the costo-clavicular ligament, and pectoralis major muscle below. The scapular portion is displaced in three directions, namely, downwards, inwards, and forwards; downwards, chiefly by the weight of the extremity, assisted, perhaps, by the contraction of the deltoid,—and inwards and forwards by the pectorales muscles, the broken clavicle being no longer able to keep the shoulder outwards and backwards. The scapular part of the clavicle is thus drawn under the sternal portion, so that the one part rests upon the other.

Treatment.—The parts are to be brought on a level with each other, and the fractured ends into apposition, and to be preserved in this situation. To effect this the outer portion of the bone must be raised upwards, and also drawn outwards and backwards; which may be done by pressing the humerus very forcibly upwards, and keeping it raised by a short sling; and then placing a thick pad beneath the axilla, drawing the arm backwards and bandaging the elbow firmly to the trunk. The pad acts as a fulcrum, the humerus as a lever, and the bandage as the power; and thus the upper part of the humerus, and with it the scapula and the outer portion of the clavicle, are drawn outwards and backwards.

In the treatment of this fracture many different kinds of appliances have been used. At one time it was the practice of many, when the shoulders had been drawn back and were held fixed in that position, to place one end of a roller in the axilla of the injured arm, then to apply the roller obliquely across the back over the shoulder of the opposite side, and afterwards to wind it through the axilla of that side, and from that obliquely upwards over the shoulder of the affected side, and having made this figure-of-8 turn secure, to make several other turns successively in the same manner. The shoulder having been thus bandaged back, the arm was placed in a sling. This is what was called the treatment by the figure-of-8 bandage. One objection to this treatment is, that the roller is apt to become roped, and o excoriate the edges of the axilla. To remedy this inconvenience, Brasdor suggested, as an improvement, the bandage which bears his ame. It consists of a back-piece of stout leather, softly cushioned, vith two well-padded straps attached to the sides, and a belt running long its lower margin to surround the waist, and to fix the bandage n its proper position. One of the straps is passed under each axilla, nd returns over the shoulder to be buckled to the upper part of the ack-piece: the back-piece is divided down the middle, and the two ortions are connected by a lace, in order that they may fit persons of arious sizes.

Fig. 59.



s figure shows Brasdor's bandage for fracture and dislocations of the clavicle.—From COOPER.

The object of this appliance is to draw back the shoulder; but s alone is insufficient. In treatment of fracture of the clavicle, ce things are requisite:—to elevate the shoulder, to carry it out m the chest, and to throw it backwards so as to produce extension the clavicle, and bring its overlapping ends into contact. With se views, and to effect these purposes, Desault constructed his dage, which consisted of two single-headed rollers, each nine yards length, and a wedge-shaped pad for the axilla. The pad is placed the axilla, and retained by two ribands attached to it, which are l over the opposite shoulder; the elbow is brought forward, lifted and pressed inwards against the chest, thus making the humerus as a lever upon the pad in the axilla, for the purpose of extending the fractured clavicle. The arm being supported in this position with the elbow bent at a right angle, one of the rollers is carried round the chest and upper arm, being drawn more tightly as it approaches the elbow; a compress, dipped in camphorated spirits, is next laid upon the fractured bone, and the second roller, commencing in the opposite axilla, is carried across the chest, and over the compress and shoulder; then, passing down behind the arm and under the elbow, it is again taken across the chest, and over the sound shoulder to the axilla, where it commenced; and the same course is repeated till the roller terminates. The turns are secured by pins or stitches, and the hand is supported by a sling.

Brunninghausen recommended for the treatment of this fracture, a leather strap, put on like the figure-of-8 bandage, with two pads fixed upon it, to prevent excoriation of the axilla.

Of these four plans of treatment, the first two, together with Brunninghausen's, act on the same principle, namely, that of keeping back the shoulder; but they leave unfulfilled the other indications, which are no less important. They are also liable to the following objection:—if any of the three different appliances be drawn tight to fix the shoulder, the shoulder will be drawn towards the chest, and, in consequence, the fractured parts will not be in apposition. On the other hand, the method of treatment recommended by Desault is scientific and excellent; but, as his manner of bandaging is rather complicated, and in the case of females very inconvenient, it has never been very generally adopted in this country.

The following plan of treatment, recommended by my late friend Mr. Liston, is simple, judicious, and unobjectionable. "When the patient is seen immediately after the accident, the bones are without delay, and before inflammatory swelling has come on, to be placed in apposition and retained. No complicated apparatus is required. A pad, firm, though of soft material, and large enough to fill the armpit completely, is rolled in a shawl, and placed in the axilla; it is retained by tying the shawl over the opposite shoulder, a soft pad being interposed between the knot and the skin to prevent excoriation, and is further secured by tying the ends under the axilla of the uninjured extremity, which should also be protected by a small cushion.

"A few turns of a roller, or a handkerchief, are placed round the arm and chest, so as to secure and fix the limb, and the retentive apparatus is completed. The shoulder is thus raised, and removed from its unnatural position, and the fractured extremities of the clavicle, previously placed in accurate contact, are prevented from being again displaced. The elbow and the fore-arm should be supported by a sling, otherwise the unsupported weight of the limb dragging on the shoulder will cause considerable pain, and subsequent displacement will be apt to occur. The apparatus should be looked to occasionally, adjusted, and tightened; and the cushions should be replaced by fresh ones, to prevent excoriation and uneasiness. The bone will be found to be quite smooth, to remain of its proper length, to unite generally within twenty days, and that without any unseemly exuberance of callus. No compress or splinters need be applied over the bone; no evaporating lotions are necessary."

FRACTURES OF THE THIGH-BONE.

FRACTURES OF THE NECK OF THE THIGH-BONE.

Fractures of the neck of the femur may take place in any point of its extent; and they often extend outwards through the trochanter major, but very seldom inwards, so as to traverse the articular surface. The articular surface presents a remarkable difference as to its tendency to disease, and its liability to injury from fracture. It is very prone to disease; it is scarcely ever the subject of fracture.

Arrangement.—Fractures of the cervix femoris are divided into three classes :—

1st. Intra-capsular transverse fracture, so named from its being within the capsular ligament, and nearly forming a right angle with the long axis of the neck of the femur.

2nd. Extra-capsular transverse fracture, when the fracture is without the capsular ligament, and the neck is broken off at its junction with the trochanter major.

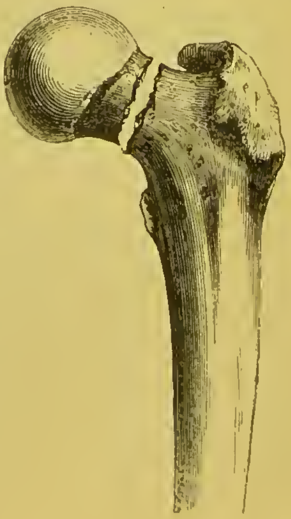
3rd. Oblique fracture of the neck, extending through the trochanter major. This fracture may be partly within, and partly without the capsular ligament.

INTRA-CAPSULAR TRANSVERSE FRACTURE.

Symptoms.—I. Shortening of the extremity of the affected side.

This symptom may be discovered by placing the patient straight on his back, and comparing accurately the two limbs, knees, and ankles; or by comparing the measurement, between a fixed point of the pelvis and one below the supposed fracture, with the measurement between the corresponding point on the opposite side of the body. In the entire state of the bone, the muscles extending from the pelvis to the femur are kept somewhat on the stretch by the resistance which the neck and head of the bone offer to their contraction; but when the neck is fractured, the resistance is diminished, and the femur is consequently drawn up by the contraction of the muscles. When the patient is in the recumbent posture, the shortening is caused entirely by the action of the muscles; but in the erect position, not only is the part external to the

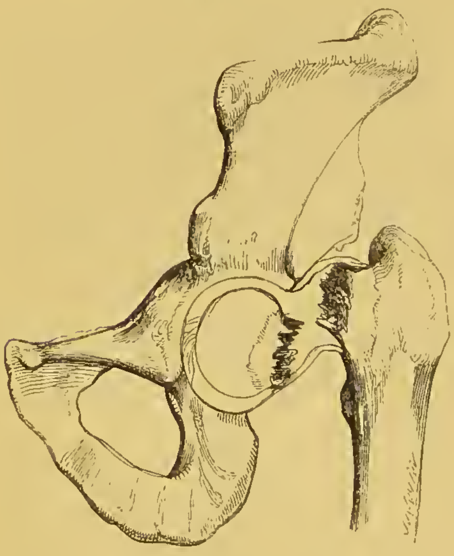
Fig. 60.



fracture drawn up by the muscles, but also the part of the neck internal to the fracture is pressed down by the weight of the body.

This symptom is usually less apparent immediately after the injury than at a subsequent period, some time being required for the complete contraction of the muscles. As shortening is a symptom of some of the dislocations of the hip-joint, it is of the greatest importance, for the purpose of diagnosis, to attend to all the distinguishing peculiarities of the shortening from fracture. In addition to the peculiarity already stated, namely, that the shortening is not so apparent immediately after the injury, until the muscles have had time to contract, it may be remarked, that for some time the injured limb may, by being drawn down, be easily made of the same length as the other, but it returns to its former position as soon as the extending force is discontinued. After a very considerable period, however, the muscles become so permanently contracted, that they are capable of resisting a force which was previously sufficient to bring down the limb.

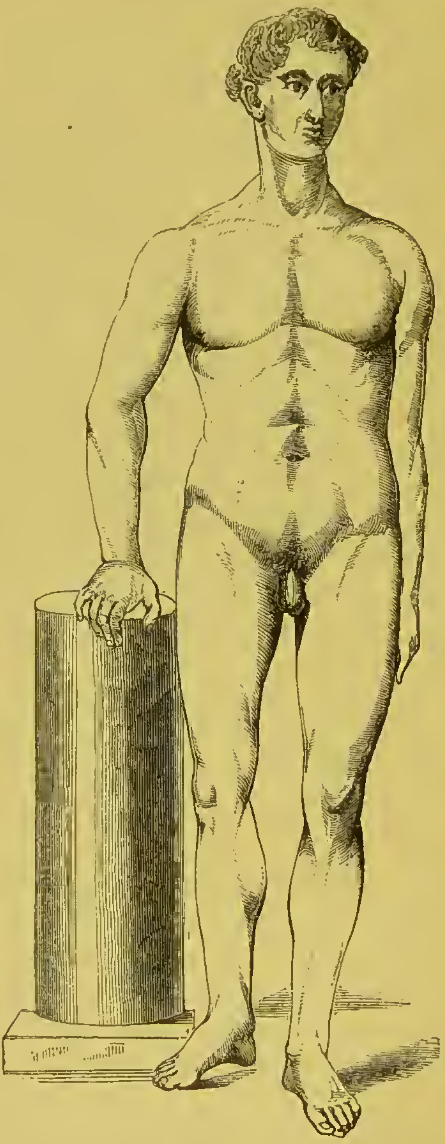
Fig. 61.



From Cooper.

The degree of shortening varies much in different kinds of fracture. In intra-capsular fracture there is a difference of opinion on the subject among surgical authorities. Sir Astley Cooper states,—"The leg becomes from one to two inches shorter than the other, for the connexion of the trochanter major with the head of the bone by means of the cervix being destroyed by the fracture, the trochanter is drawn up by the muscles as high as the capsular ligament will permit, and consequently rests upon the edge of the acetabulum, and upon the ilium above it." The degree of shortening here specified is greater than has been found in the experience of Boyer, and some other continental authorities, or in that of Messrs. Liston, Stanley, S. Cooper, and R. W. Smith. Mr. Smith states as the result of his observation, that the shortening in this fracture varies from a quarter of an inch to an inch, and in this opinion most surgical authorities now agree. Mr. Smith refers to fifteen examples of fracture of the neck of the femur in the Museum of Richmond Hospital, thirteen of which were taken from patients who died in the hospital, and in each case the degree of shortening was carefully observed. In one instance only did it exceed an inch, and in that it was an inch and a half; but the accident had happened some years previous to the measurement, and the neck of the bone had been absorbed. In two instances I had the opportunity of measuring the degree of shortening, and of verifying by dissection that the fractures were entirely within the capsular ligament. The one case was that of a woman, seventy years of age, and the shortening was three-quarters of an inch. Death took place two months after the accident, and on dissection, the fracture was found to be within the capsular ligament, which did not appear to have been lacerated. The other case was that of a man, whose precise age could not be ascertained, but who appeared to be considerably above forty years: he met with this fracture, together with that of several ribs, and other serious injuries, by falling from the top of a house upon the pavement. The shortening equalled one inch. Death took place ten days after the accident; and on dissection, it was found that the fracture was entirely within the capsular ligament, which in this instance was rather extensively lacerated, especially above. The extent of retraction seems to depend very much on the circumstance whether or not the capsular ligament over the neck of the bone be torn; for although, as Boyer remarks, it yields a little without being torn, yet if it remains entire, or nearly so, retraction may be almost completely prevented. This was found to be the case by Smith, Stanley, and others; and Mr. Liston remarks with regard to the same point,—"In fracture within the capsule and where the fibrous envelope of the neck of the bone is not completely torn, there can be but slight displacement; and by the most attentive comparison of the two limbs, abbreviation of the one which has sustained the injury may not be detected."

Fig. 62.



Sebatier, Dupuytren, and others have found in many cases that there was no shortening for many days after the injury, and that then it took place very suddenly on the patient making some exertion, or during some movement in the examination of the limb. This sudden shortening at a period remote from the injury is accounted for by Dupuytren on the supposition that the fracture is within the capsular ligament, and by reason of some irregularity in the fractured surfaces, the one fragment is wedged into the other, or the displacement of the one prevented by the position of the other; but that during some movement of the limb, the relations of the fragments become so altered as to admit of retraction. Mr. Smith and others agree with Dupuytren in viewing it as a sign of the fracture being within the capsular ligament, but they attribute it to the ligament suddenly giving way at the moment of the retraction.

II. *Eversion of the Foot and Knee* is a frequent, but not invariable symptom of this fracture. There is a great difference of opinion as to the cause of this symptom. Sir Astley Cooper considered, and most British surgeons agree with him, that it is occasioned by the rotator muscles. Bichat and Boyer thought that it is produced by the weight of the foot. Dupuytren ascribes it to the direction of the fracture, and the relations of the fractured portions to each other; and Mr. Liston says,—"The position would appear to depend upon chance in a great measure, and upon the way in which the limb has bent under the patient, or has been placed on his being taken up. The position may be altered during the examination of the limb; it may first be inverted, and afterwards, by the weight and inclination of the limb and foot, and the action of the powerful rotators outwards, the toes may become everted." In explanation of the more general outward direction of the toes, Sir Astley Cooper remarks,—"This state depends upon the numerous and strong external rotatory muscles of the hip-joint, which proceed from the pelvis to be inserted into the thigh-bone, and to which very feeble antagonists are provided; thus the obturators, the pyriformis, the gemini and quadratus, the pectinalis and triceps, all assist in rolling the thigh-bone outwards; whilst only a part of the glutæus medius and minimus, and the tensor vaginæ femoris are the principal agents in rotation inwards. It has been denied that this eversion is caused by the muscles, and it has been attributed to the mere weight of the limb; but one may satisfy himself that it arises chiefly from the muscles, by feeling the resistance which is made to any attempt at rotation of the thigh inwards. This difficulty of rotation inwards is also in some measure attributable to the length of tho cervix femoris, which remains attached to the trochanter major, because in proportion to its length which rests against the ilium, the trochanter is prevented from turning forwards." In addition to the tensor vaginæ femoris and anterior parts of glutæus medius and minimus, the two ischio-tibial muscles, namely, the semi-tendinosus and semi-membranosus muscles should be enumerated as rotators inwards. When the foot is advanced, they prevent the heel from being so much turned inwards as to obstruct the other foot; but since they are more relaxed than usual by the shortening of the extremity, they can in this fracture have no effect in counteracting the powerful rotators outwards. Eversion does not take place to its full extent for some hours, as the contraction of the muscles is gradual.

Bichat and Boyer, as it has been already stated, attributed the eversion to the weight of the foot, and thought that if it were caused by muscular contraction, there would be more difficulty in turning the foot inwards. Bichat also objected, that if the eversion were occasioned by the action of the rotators outwards, this position of the foot would be invariably met with, which is not the case; an objection which applies as strongly to his own explanation as to that which he rejects; and he further states, that in consequence of the fracture, the external rotator muscles, going from the pelvis to the part of the thigh-bone beyond the fracture, have, with the exception of the quadratus femoris, their extremities approximated, and are, consequently, in a state of relaxation. In answer to this, it has been stated, that the general influence of the muscles is to draw up the trochanter, and thus to operate against the relaxation of the rotators, and even to augment their influence.

Dupuytren suggests that the position of the foot may depend on the direction of the fracture, and the relative situation of the fragments; that if the outer fragment be in front of the inner, the foot will be turned outwards, but if the outer be behind the inner fragment, the foot will be inverted.

Although eversion is the usual position of the foot in fracture of the neck of the thigh-bone, it is necessary to remember that inversion is occasionally found. The following case, recorded by Mr. Stanley, is a striking instance of this, while it also shows the importance of correct diagnosis:—"A middle-aged man fell in the street, and his hip struck the kerb-stone. The immediate consequences were, that the limb was inverted and shortened to the extent of an inch, and no crepitus could be discovered. It was presumed that a dislocation had occurred, and accordingly an extension of the limb was made, and so great was the constitutional irritation occasioned by the repeated trials to reduce the supposed dislocation, that the man died about five months from the time of the accident. In the dissection of the hip, a fracture was found, extending obliquely through the neck of the femur, *but entirely within the capsule.* A portion of fibrous and synovial membrane on the anterior side of the neck of the bone had escaped laceration." The surgical authorities of this country record many cases of inversion, in addition to the above-mentioned example given by Mr. Stanley. Sir Astley Cooper, in his work on Dislocations, mentions the case of Mrs. Whateley, sixty years of age, in which the toes were turned inwards, and on dissection the fracture was found within the capsular ligament. Mr. Guthrie refers to a case of Mr. Langstaff's, in which there was inversion, and on dissection there was found a diagonal fracture through the trochanter major. He also mentions a case in which the limb, having been in the first instance everted, suddenly turned inwards when the patient began to use it. Some French authorities refer to inversion in fractures of the neck of the femur as a more frequent symptom than it is admitted to be by surgeons of this country. Desault concluded from his experience that the cases of rotatory derangement inward were to those outward in the proportion of 1 : 4.

As to the occasional occurrence of inversion, there is now no doubt; but much difference of opinion exists as to its cause. Some have supposed that the capsular ligament remaining entire in the front of the joint, and retaining an attachment to the bone beyond the fracture, might cause inversion; but although this condition might possibly prevent eversion, and even that is doubtful, it could have no effect in causing inversion. Others agree with Dupuytren, who attributes the direction of the foot in every fracture of the neck to the relative positions of the fractured portions; and if this explanation be not correct, the cause of inversion in fracture, entirely within the capsular ligament, remains still undiscovered. Mr. Guthrie has explained, in a most satisfactory manner, the cause of inversion in some fractures, without the capsular ligament. If the fracture be so situated, that the attachments of the rotators outwards, inserted into the digital cavity, are connected with the fragment between the fracture and the joint, and the attachments of the anterior fibres of the glutæus medius and minimus, to the anterior part of the trochanter major, are connected with the bone beyond the fracture, then the anterior fibres of these muscles will produce rotation inwards. This explanation, however, though most satisfactory in certain fractures without the capsular ligament, will not apply to fractures entirely within it.

III. Another distinguishing peculiarity of fracture, is the absence of a fixed condition of the limb. It cannot usually be moved by the voluntary efforts of the patient, but it can be lengthened, or turned inwards or outwards by the surgeon, on the application of very slight force, but it returns to its former position as soon as the force is removed. This is a good diagnostic symptom for distinguishing a fracture with the rare symptom of inversion from dislocation, in which the extremity is fixed, and cannot be restored to its former position, without very great force, and when restored, it remains in the proper position, and the natural mobility returns.

IV. Crepitus is another symptom. If the patient be placed in the horizontal position, and the limb, if retracted, lengthened so as to bring the fragments to a level with each other, it may be readily discovered, by placing one hand over the trochanter major, and giving to the limb a quick rotatory motion with the other.

V. The degree and kind of revolution performed by the trochanter under the hand, when the limb is rotated, is an evidence of the existence of fracture, and of its proximity to the trochanter. When the neck of the bone is entire, the trochanter during rotation describes a segment of a circle, the centre of which is in the joint; but in fracture it seems to turn on its own axis, or to describe an arc of greater or less extent, according to the distance or proximity of the fracture to the trochanter.

VI. The other symptoms are, pain, which is less in this than in the other fractures of the neck, and is not much felt, except when the limb is moved; and some unnatural appearances near the injury, such as the trochanter being less prominent than usual, and too near the crista of the ilium; and there being an unusual fulness of the hip caused by the bulging out of the muscles between the ilium and trochanter, and a swelling, more or less conspicuous, at the upper and fore-part of the thigh. The only injuries for which this fracture could be mistaken are, dislocation forwards of the hip-joint, when the fracture, as is usual, is attended with eversion (the diagnosis between them will be pointed out when the dislocation is described); and dislocation upwards or backwards, when the fracture is attended with the rare symptom of inversion.

In the dislocations the shortening is greater; the inversion is much more than even in the rare instance of its being found in fracture; the knee is brought forward; there is immobility of the whole limb, and the absence of crepitus; whereas in fracture with inversion, the shortening and inversion are less; the limb is so movable, that by a very slight force it may be rotated, or bent backwards and forwards, which, however, causes great pain, and there is crepitus and the peculiarity of the revolution of the trochanter.

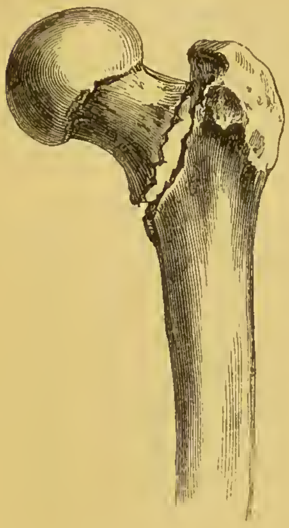
EXTRA-CAPSULAR TRANSVERSE FRACTURE.

Symptoms.—Shortening. According to Sir Astley Cooper, this varies from half to three-quarters of an inch; but, according to Mr. Smith, with whom most surgeons agree, it is usually from one inch and a half to two inches and a half. Smith, Boyer, Stanley, and Earle have all found the shortening greater in this than in the former fracture, there being nothing to prevent the muscles from drawing up the outer fragment, while the inner fragment is pressed down by the weight of the body.

Eversion of the foot. *Inversion* also sometimes though rarely occurs, as has been stated under the same symptom in the last fracture. There is always, as some term it, rotatory derangement of the limb, and for the most part, outwards.

Crepitus is another symptom, which can generally be elicited without difficulty, as in the former fracture.

Fig. 63.



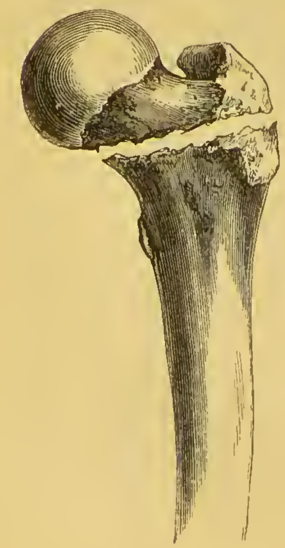
Mobility of the limb, which though immovable by the voluntary efforts of the patient, nearly to the same extent as in dislocation, can be bent, extended, lengthened, or rotated outwards and inwards by the surgeon with slight force; but it returns to its former position when the force is discontinued.

Pain, to a greater extent than in intra-capsular fracture, even when the limb is at rest; and always exceedingly severe, when it is moved by the surgeon. The severity of suffering is much greater than in the former fracture, and there is sometimes, in consequence, considerable irritative fever.

It may also be remarked, that the trochanter is less prominent than usual. If the hand be placed over it when the limb is rotated, it will seem to move on its own axis, instead of describing an arc; it is too near the crista of the ilium. The hip is altered in form, as in the last-mentioned fracture. There is swelling at the upper and fore-part of the thigh; and ecchymosis and tenderness to the touch are often observed. This fracture, though it may take place in old age, is often met with under fifty, and sometimes in early life, and is usually occasioned by much greater violence than is necessary to produce intra-capsular fracture.

OBLIQUE FRACTURE OF THE NECK, EXTENDING THROUGH THE TROCHANTER MAJOR.

Fig. 64.



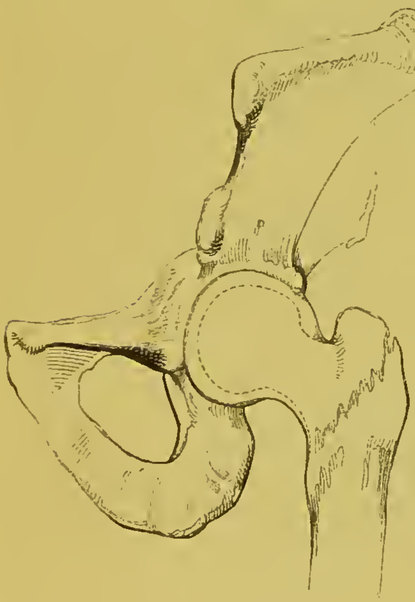
Symptoms.—If there be any shortening of the limb, which is not always the case, it is usually to a less extent than in the other fractures. The extent of surface of the fractured part, and the direction of the fracture, often prevent this kind of displacement.

Crepitus is usually perceptible, and generally the foot is turned outwards, but seldom to the same extent as in the other fractures; in some instances it is turned inwards, the rationale of which, as explained by Guthrie, is given in a former page under the head of Symptoms of Intra-capsular Fracture. The foot is benumbed, the patient is unable to sit, and any attempt to do so causes great suffering, nor can he turn in bed without much pain; great tenderness is felt on pressure, and ecchymosis may often be discerned. In some cases the upper part of the trochanter does not obey the motions of the limb, but remains at rest; sometimes it is drawn upwards, and a separation is perceptible between it and the rest of the bone; and if the fracture be very oblique and below the attachments of the principal rotator muscles, the bone may be drawn up by the glutæus maximus, and a considerable shortening of the limb thus occasioned. This last symptom, however, is more characteristic of oblique fracture of the trochanter major, not extending, or very slightly extending, into the neck.

This fracture is usually the result of very great violence applied to the trochanter.

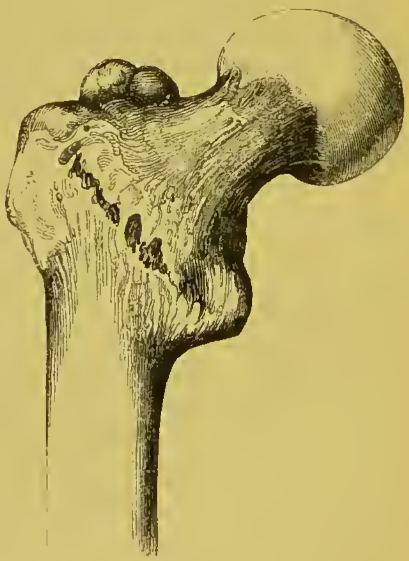
Oblique fractures sometimes happen through the trochanter major, without implicating the neck of the bone. Of this accident the two accompanying figures are illustrations.

Fig. 65.



From Cooper.

Fig. 66.



From Cooper.

PERIOD OF LIFE AT WHICH FRACTURE OF THE NECK MOST FREQUENTLY OCCURS.

The patients under Dupuytren, having fracture within the ligament, were almost all above fifty years of age; and Sir Astley Cooper says,—"I have now been thirty-nine years connected with St. Thomas's and Guy's Hospitals, and for thirty years have enjoyed no inconsiderable share of the surgical practice of London. In the two hospitals there are one thousand and fifty patients, and I believe eight cases of fracture of the upper part of the thigh-bone occur in each year; but in order to avoid exceeding the average number, I will consider them only as five per annum; thirty-nine multiplied by five produce one hundred and ninety-five; adding to these one case only in each year in my private practice of 30 years, they will collectively amount to two hundred and twenty-five cases. Now in that time I have only known two cases of fracture of the neck of the thigh-bone within the capsular ligament occur under fifty years of age; one was in a patient aged thirty-eight years, who had an aneurism of the iliac artery, and the other was kindly shown to me by that excellent anatomist and surgeon, Mr. Mayo."

Mr. Stanley has recorded a case of the kind in a boy aged eighteen years; and in the museum of Guy's Hospital there is a specimen of fracture of the neck, which, however, involves the trochanter, taken from a child nine years of age. Fracture within the capsule is almost exclusively confined to persons above fifty years of age; it is very seldom met with in adults below that age, and is still more uncommon in children: women of advanced age are more liable to it than men. The causes of these differences will be explained below. The other two varieties of fracture of the neck may take place in advanced life; but they occur under fifty years of age more commonly than intra-capsular fracture, and are usually the result of great violence, whereas a very slight accident is sufficient to occasion fracture within the capsular ligament.

Causes.—The causes may be divided into exciting and predisposing causes. The exciting causes of the several fractures have been arranged by Dupuytren in the following order, according to their frequency:—1. Falls on the trochanter. 2. Direct violence, such as that of a gun-shot wound. 3. Falls on the foot or knee. 4. Muscular action, as recorded to have taken place once in tetanus. According to Desault's experience, in twenty-four cases out of thirty the accident was occasioned by falls on the trochanter; whereas Sir Astley Cooper found the most common cause to be a slip off the edge of the foot pavement. He remarks with reference to fracture within the capsule:—"In London, the accident most frequently occurs when persons walking on the edge of the elevated footpath slip upon the carriage pavement; though the descent be only a few inches, yet being sudden and unexpected, and the force acting perpendicularly with the advantage of a lever in the cervix, it produces a fracture in the neck of the thigh-bone; and, as a fall is the consequence, the fracture is imputed by ignorant persons to the fall, and not to its true cause. Other trivial accidents may also produce this fracture. I was informed by a person, that being at her counter, and suddenly turning to a drawer behind her, some projection in the floor caught her foot and prevented its turning with the body, by which the neck of the thigh-bone became fractured. A fall on the trochanter major will also produce it; but I have dwelt particularly on the *slight* cause by which it is occasioned, that the young surgeon may be upon his guard respecting it; as he might otherwise believe that an injury of such importance could scarcely be the result of a slight accident, and that excessive violence is necessary to break the neck of the thigh-bone: but such an opinion is as liable to be injurious to his reputation, as the error of confounding this accident with dislocation." Sir Astley Cooper found the other two varieties of fracture to result generally from a violent blow, or a fall on the trochanter. In fracture within the capsule, when caused in the manner already described, the fall is often the consequence of the accident; in the others, the accident is generally the consequence of the fall.

When a person falls on the great trochanter, the neck of the femur is acted on by that eminence, which has a *point d'appui* on the ground, and by the weight of the body, which acts immediately on the head of the femur. By this action and reaction a force is exerted on the neck of the femur, which tends to make it parallel with the rest of the bone. In falling on the feet, on the contrary, the tendency of the fracturing cause is to force the neck of the femur to form a right angle with the bone; and if this force be exerted on the bone beyond its natural extensibility, a fracture must ensue.

According to the two last-mentioned views of the mechanism of these fractures, they are not direct, that is, not produced by a cause acting immediately on the part, but the effect of a force communicated to that part by *contre-coup*, or transmitted reaction. If, however, the fracture be the result of a severe contusion or fall, and be through the trochanter or without the capsule, the fracture is so near to the part to which the violence is applied that its influence may be said to be direct.

The different degrees of frequency with which these fractures occur at the different periods of life, and in the two sexes, may be explained by anatomical and other considerations. In the child, the trochanter is concealed under the prominence of the os innominatum; the trochanter projects but slightly, and the axis of the neck approaches that of the shaft. These circumstances, together with the diminished breadth of the pelvis, the great flexibility of the neck, and the adipose and cellular tissues which are all protective, account for the extremely rare occurrence of these fractures in childhood. In adults the pelvis is broader, the trochanter is more prominent, the neck is longer, and its inclination to the shaft is at a greater angle; there is, consequently, more liability to fracture in mature age than in childhood, and there would be still more than there is, but for the great strength and solidity of the bone at that period. In advanced life the pelvis is still broad, the trochanter is prominent, and often but little protected, in consequence of the diminished size of the muscle and the decrease of the adipose and cellular tissue; and the neck of the thigh-bone, besides being nearly at a right-angle with the shaft, is also rendered exceedingly brittle by the diminution of cartilaginous matter and the increase of phosphate of lime; as also by a peculiar process of atrophy, which has been admirably described by Sir Astley Cooper. To these circumstances is ascribed the greater liability to fracture in old age.

Dupuytren states, that the frequency of this accident bears a direct ratio to the prominence of the trochanter major, the length of the neck, and its angle with the shaft, and he ascribes the greater liability to it in women to the circumstance that the neck of the femur is longer and the trochanter is more prominent, while the size and prominence of the muscles which would protect the bone, are often less in this sex than in the other. The very liability to fall in old age must also increase the frequency of fracture. The observations of Sir Astley Cooper, above referred to, are as follows:—"The neck of the thigh-bone in persons of middle age has a close cancellated structure, and is covered by a shell of considerable thickness; but in old subjects the cancellated structure degenerates into a coarse network, loaded with adipose matter, and the shell which covers it becomes so thin that when a section is made through the middle of the head and cervix, it is found diaphanous. Of this I have several specimens. As the shell becomes thin, ossific matter is deposited on the upper side of the cervix, opposite the edge of the acetabulum, and often a similar portion at its lower part, and thus the strength of the bone is in some degree preserved. This state may be frequently seen in very old persons. When the absorption of the neck proceeds faster than the deposit on its surface, the bone breaks from the very slightest causes, and this deposit wears so much the appearance of a united fracture that it might easily be mistaken for it. Before the bone thus alters, we sometimes meet with a remarkable buttress shooting up from the shaft of the bone into its head (formed of strong cancelli), giving it additional support to that which it receives from the deposit of bone upon its external surface.

"But another change is also produced, of which the following is the history. Old, bed-ridden, and fat persons, generally females, often used to be brought into our dissecting-room with some of their bones broken, and more frequently the thigh-bone than any other, in being removed from the grave. If the cervix femoris of such persons be examined, it will be found that the head of the bone is sunk down upon its shaft, and that the neck of the thigh-bone is shortened, so that its head is in contact with the shaft of the bone opposite to the trochanter minor; and at the point at which the ligament is united with the neck of the bone, the phosphate of lime is absorbed, and a ligamento-cartilaginous substance occupies its place, either extending (as a plane) entirely through the neck of the bone, or partially, so that one section exhibits signs of it, and in another it is wanting. The bone in some cases is so soft and fragile, both in its trochanters and head, that it will scarcely bear the slightest handling; and the motion of the thigh-bone in the acetabulum is almost entirely lost, so that the persons must have had but little use in their lower extremities. In examining the body of an old subject very much loaded with fat, in the dissecting-room of St. Thomas's Hospital, I found that the gentleman who had dissected one limb had cut through the capsular ligament of the hip-joint, and tried to remove the head of the thigh-bone from the acetabulum, but the neck of the bone broke on the employment of a very slight force, and upon a farther trial to remove it, the bone crumbled under the fingers. As the other limb was not yet dissected, I requested Mr. South, one of our demonstrators, to remove with care the upper part of the other thigh-bone, but, although he used great caution in doing it, he could not remove the bone without fracturing the upper part of its shaft; but he succeeded in removing the upper part of the bone, so that it might be preserved; and of this I have given plates. We have here then a case in which the neck of the bone was absorbed, so that the head was brought in contact with the trochanter; in which, most decidedly, there had not been a fracture, although it had in some parts the appearance of one, and in which the disease occurred in each hip-joint.

"But the best specimen of this state is the following, which I preserve with the most assiduous care, and value in the highest possible degree. I have had, for twenty years, in the collection of St. Thomas's Hospital, the thigh-bone of an old person, in which the head of the bone had sunk towards its shaft. I have been in the habit of showing this bone twice a-year, as a specimen how bones sometimes become soft from age and disease, and from the absorption of their phosphate of lime; and I have frequently cut with a pen-knife both its head and its condyles, to show the softened state. On sawing through its cervix, the cartilage, deprived of its phosphate of lime, had dried away in several parts; and the appearance was such, that a person ignorant of the change would have declared it to be a fracture, only that in some sections the cartilage has taken different directions (as a thin plane between the head and neck), and in some, the bone was not yet entirely absorbed."

MODE OF UNION.

In two of the three kinds of fracture of the cervix femoris, namely, extra-capsular transverse fracture, and oblique fracture through the trochanter major, the reunion is, as in other parts of the body, by bone; but this mode of union is extremely rare in intra-capsular fracture. It was at one time a question about which there was much difference of opinion, whether reunion by bone could ever take place in fracture entirely within the capsular ligament, and where the head of the bone is completely insulated, except at its attachment to the acetabulum by means of the round ligament. The French surgeons believed that it could, and affirmed that preparations in their museums in Paris demonstrated that mode of union. Several British surgeons were of the same opinion. M. Roux, of Paris, sent a specimen of what he believed to be reunion by bone, to Sir Astley Cooper; but Sir Astley was not satisfied, because the traces of reunion in that preparation were such as to indicate a fracture in which the internal fragment retained a connexion with the capsular ligament. Mr. Cross, of Norwich, in the account of his visit to the French hospitals, states that he examined the preparations in the museums of Paris, which were believed to demonstrate union by bone, but that he did not consider them satisfactory.

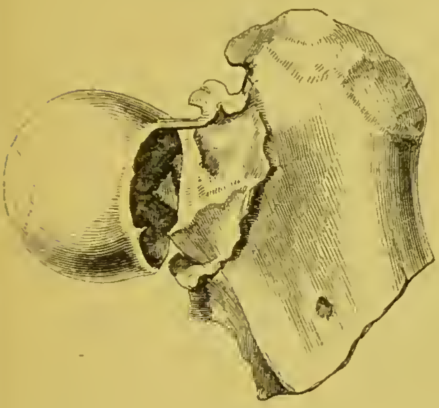
No one in this country has devoted more attention to the investigation of this subject than Sir Astley Cooper; and to show how rare an occurrence union by bone is in fracture entirely within the ligament, he enumerates not fewer than forty-three specimens of this fracture in different collections in London, and states that during his practice of forty years he had seen but two or three cases which militated against the opinion that union by bone cannot take place, and only one in which a bony union had taken place, or which did not admit of motion of one bone upon the other. Sir Astley Cooper never denied the possibility of bony union; he states that it would be presumptuous to maintain that there could be no exception to the general rule; but he has proved that such exceptions are rare. Several cases are recorded, in which bony union unquestionably took place; and we may therefore conclude, that it may occur in very favourable cases, and under good treatment. Of various instances on record, I shall refer to three only.

Mr. Longstaff's museum contained an unquestionable specimen of ossific union. The preparation is now in the Museum of the Royal College of Surgeons of England, where I have examined it. The particulars of the case are recorded in the "Medico-Chirurgical Transactions." The patient died about two years after the accident. The ossific union is perfect in the shell, and all round the circumference of the bone; the centre of the fissure is united by a fibrous substance.

Another instance of bony union occurred in the case of Dr. James, an English physician, who met with this fracture by a fall from his horse, while riding in the neighbourhood of Bordeaux. He recovered from the accident, but died seven months after it, of visceral disease; and, on examination by Dr. Brulatour, of Bordeaux, it was found that the fracture was entirely within the capsule, and that the union by bone was perfect.

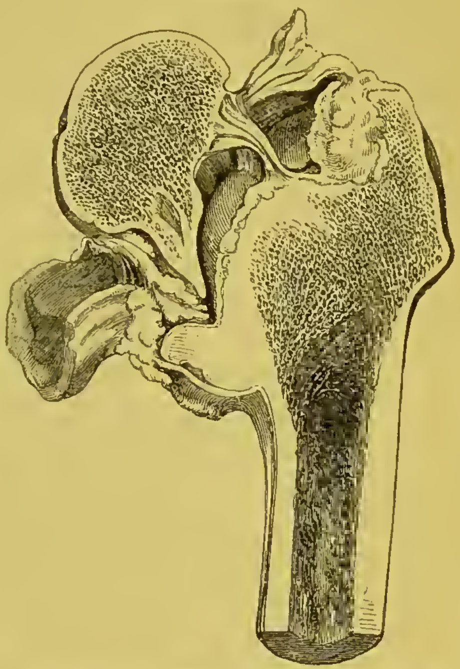
In the second edition of Mr. Liston's "Elements of Surgery," there is a drawing of complete bony union, which, Mr. Liston says, he is enabled to produce by the kindness of Sir Astley Cooper. The possibility of bony union is thus clearly demonstrated, but still it cannot be looked for except in very favourable cases, and what has been already described as the frequent condition of the neck of the thigh-bone in aged persons, must render it in many instances hopeless. In the majority of cases of intra-capsular fracture no union takes place, and the broken surfaces become smooth and polished from being covered over with what has been called the ivory deposit; or they may become joined to each other, or to the inner surface of the capsular ligament, by fibrous bands; the capsular ligament and surrounding tissues become very much thickened and strengthened; and thus the unnatural motion is limited. The neck of the femur disappears by interstitial absorption, and the diminished head rests between the two trochanters. These conditions, or some combinations of them, are the appearances which present themselves where bony union has not taken place.

Fig. 67.



Intra-capsular transverse fracture of cervix femoris, followed by absorption of the neck and conversion of part of capsular ligament into exceedingly thick bands. From a preparation in my museum.

Fig. 68.



This figure exhibits a fractured cervix femoris partially united by bands of ligament; the neck of the bone is entirely atrophied, so that the head and shaft are brought into contact, and their surfaces are rendered smooth by friction; the capsular ligament is excessively thickened; and there is a projection formed by the trochanter minor, on which the head of the bone rested.—From Sir A. Cooper.

CAUSES OF THE WANT OF UNION.

1. One circumstance which prevents bony union of the fragments is the want of proper and constant apposition. This is only in accordance with what is observed in other parts of the body, when fractured bones cannot be kept in contact. Under such circumstances ossific union rarely takes place.

2. Various proofs may be adduced that a certain degree of pressure

of the fractured parts against each other is favourable to union. In the present case that pressure cannot easily be maintained; and this is another circumstance which contributes to prevent union.

3. The atrophy of the cervix femoris, already described, not only predisposes to fracture, but also diminishes in a very great degree the power of reparation. This, and the want of vigour belonging to old age, even if no other reason could be assigned, would be sufficient to account for the want of union.

4. A fourth reason is the feeble circulation through the head and neck on the inner side of the fracture, for, there being no periosteum, its circulation and vitality are kept up entirely by the vessels of the round ligament; nor can the separated portion of the bone receive nutrition from any other source.

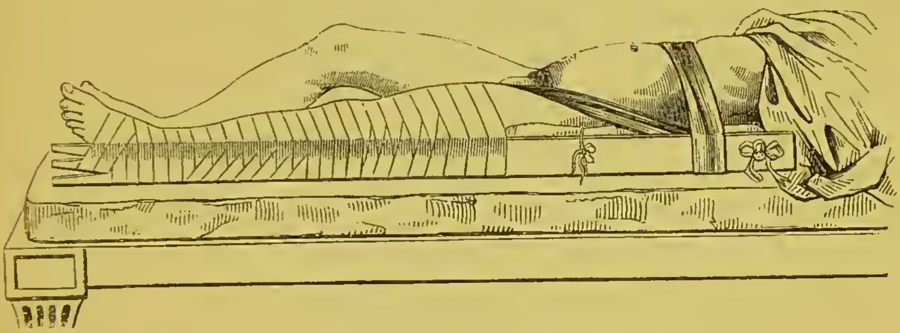
5. Another reason which has been assigned is, the circumstance of the synovial fluid being poured into the injured cavity; but the effect of this is doubtful.

Treatment.—The first question is,—Are we justified in subjecting the patient to a long and hazardous confinement to his bed for the chance of union? The answer to this will depend on the degree of probability that exists that union will take place. It will now be evident, that the inquiries into the changes which the neck of the bone undergoes in age, the circumstances under which reunion takes place, and the causes which prevent it, are of great practical importance. In intra-capsular transversed fracture in advanced life, when there is little, if any, chance of reunion, it would be injudicious to run the risk of ruining the general health by long confinement to one position, and incur the danger of ulceration and sloughing of the integuments of various parts from the weight of the body, and the application of apparatus for adapting and retaining the parts in apposition. Sir Astley Cooper remarks,—"Baffled in our various attempts at curing these cases, and finding the life of the patient occasionally sacrificed under the trials made to unite them, I should, if I sustained this accident in my own person, direct that a pillow should be placed under the limb throughout its length, and that another should be rolled up under the knee, and that the limb should be thus extended until the inflammation and pain have subsided. I should then daily rise and sit in a high chair, in order to prevent a degree of flexion which would be painful, and, walking with crutches, bear gently on the foot at first, then gradually more and more, until the ligament became thickened, and the muscles increased in their power. A high-heeled boot should be next employed, by which the halt would be much diminished."

In extra-capsular transverse, and in oblique fractures through the trochanter, and even in intra-capsular transverse fractures in very favourable subjects, the following treatment may be adopted:—

The patient being placed on a hard mattress, in an extended position, with the trunk, thigh, and leg in a straight line, a common bandage being applied from the toes to above the knee, to prevent œdema, and coaptation having been obtained by extending the extremity, and placing it in a proper position, with the toes not too much turned inwards or outwards, a wooden splint of sufficient strength and breadth, and long enough to extend from the last rib to three or four inches beyond the foot, with two holes at its upper, and two notches or retiring angles at its lower, extremity, should be well padded and applied to the outer side of the limb, care being taken to protect the ankle by a suitable adjustment of pads. The leg and foot should then be fixed to the splint by a roller, from the foot to above the knee; and if the roller, after some turns of it have been applied to the ankle, be passed through the notches, it will fasten the foot to the extremity of the splint, and prevent it from moving. A broad bandage should be applied around the pelvis, and carried down the thigh so as to include all the part above the former roller, and by the turns of this bandage, or by a very broad band, the splint should be fastened to the trunk, by which means the fractured parts will be kept in contact. A large handkerchief or shawl, with a little tow or hair wrapped up in it to prevent its galling the skin, should be applied with its centre in the perineum, one end behind the hip and the other in front, and these ends passing through the openings in the upper part of the splint, should then be well secured. The pelvis acts as a fulcrum, and the perineal band as the power, by tightening which, the splint and the lower part of the limb previously fixed to it can be kept down, the extension preserved, and the extremity kept of the proper length. Great care should be taken that the splint be well padded with cotton wool, wadding, or tow, to prevent the painful effects of pressure; the bandages should be reapplied occasionally during the treatment, and the perineal band frequently tightened. The apparatus will require to be continued for at least seven or eight weeks; but the time in different cases will vary, according to what is necessary for procuring union. Cures are obtained by this method as satisfactory as by any that can be adopted, and it

Fig. 69.



has the recommendation of being simple and the least annoying of any to the patient.

The indications of treatment to be fulfilled are, to preserve the extremity elongated, and at perfect rest, to prevent eversion, and to keep up pressure upon the trochanter.

Some recommend a different plan of treatment, namely, to keep the body slightly elevated, and the limb on a double inclined plane. This treatment can be more conveniently practised by means of Amesbury's bed than by any other apparatus. The first and third indications above stated are fulfilled by the footpiece of Amesbury's bed; the bed itself accomplishes the second; and the fourth and last is effected by a bandage or belt around the trunk, and a splint extending between the pelvis and the knee. I have treated cases satisfactorily by each of the above plans; but my decided impression is, that the former is to be preferred.

FRACTURES OF THE SHAFT OF THE FEMUR.

Symptoms.—These are so conspicuous as at once to satisfy the surgeon of the nature of the injury. Acute pain at the moment the injury takes place,—inability to sustain the superincumbent weight,—angular deformity in raising the limb,—sudden inability to move the limb by the voluntary action of its own muscles,—and preternatural motion of the lower part of the thigh-bone when otherwise acted on, are invariable symptoms; and the following, though not always, are generally present.

There is shortening of the extremity, if the fracture be oblique, varying in extent according to the obliquity. To ascertain the extent of shortening, or longitudinal displacement, as it is sometimes called, take the anterior superior spinous process of the ilium and some prominent point at the under extremity of the femur, or head of the tibia, and compare the measurement with that between the corresponding parts on the opposite side of the body. Shortening of the limb may be prevented by the bone being splintered, and the two fractured extremities being locked into each other. This symptom may not appear immediately, the contraction of the muscles by which it is produced being gradual. If the fracture be transverse, there may be no shortening, unless the violence which produced the injury was so great, or applied in such a manner, as to force the lower fragment from resting at any point against the upper.

Crepitation may be generally produced, more especially if the fracture be transverse, by performing rotatory motion. If the fracture be oblique, this symptom may not be perceptible, until the limb has been elongated. The presence of crepitus is an indubitable proof of the existence of fracture, although its absence cannot be taken as an indication of the contrary; for it is sometimes altogether prevented by the interposition of muscular fibres between the fractured portions.

Tumefaction to a considerable extent may be present, the foot is for the most part turned a little outwards, and the femur is most accessible to the fingers along its sides.

NATURE OF DISPLACEMENT.

If the fracture be oblique, and if it be not very near either of the extremities of the shaft,—in which case there are some modifications of the displacement to be stated afterwards,—the part above the fracture has generally two, and the part below four peculiarities of displacement. The upper fragment is drawn too far forwards by the psoas magnus and iliacus internus muscles; which, in their way from the iliac fossa and lumbar division of the spine to the trochanter minor into which they are inserted, describe an arc, the convexity of which is forward. There being no longer the usual resistance offered to the contraction of these muscles, they draw forward the upper fragment. It is also generally drawn a little outwards by the glutæus maximus muscle. Of course the upper part of the bone can undergo no retraction. The part below the fracture is displaced in the four following directions :—

1st. It is displaced backwards, chiefly perhaps by its own weight, and by being overlapped by the upper part.

2nd. It is drawn too near the mesial plane. The course of the adductor longus, brevis, and magnus, is from within outwards, and thus these muscles draw, or as their very name imports, they adduct, the lower fragment too near the mesial plane.

3rd. It is rotated outwards, thus occasioning eversion of the extremity. Some attribute this eversion to the mere weight of the limb; but as many of the fibres of the adductor muscles have the planes of their insertion farther back than the planes of their origin, it is probable that they assist in producing rotation outwards, and they will have a greater tendency to do so on account of the falling back of the lower fragment, which makes the plane of their insertion farther back than usual from those of their origin.

4th. It is drawn upwards, producing shortening of the extremity. This displacement is occasioned chiefly by the muscles which go between the pelvis and the leg, namely, the biceps, semi-tendinosus, semi-membranosus, rectus, and gracilis, assisted, no doubt, by the muscles inserted into the fragment below the fracture. If, however, the fracture be transverse, it may happen, on account of the breadth of surface of the fracture, that some part of the lower fragment presses against some part of the upper, in which case there will be no shortening; but if the fracture be oblique, the contraction of the muscles will not be prevented by the position of the fractured portions, and consequently shortening will take place.

According to Key, the displacement in fracture of the femur is not to be attributed to the action of the muscles inserted into the upper fragment; but chiefly to that of the muscles which go to the lower fragment. He supposes that the muscles surrounding the fracture and inserted into the lower fragment become the subject, first of effusion of blood, and subsequently of serous infiltration, in consequence of slight inflammation, and that they are thereby irritated, swelled, and excited to contract; and the lower fragment being movable is thus drawn up. The direction of the upper fragment, according to Mr. Key, will then depend upon the direction of the plane of the fracture. If the fracture go from above downwards, and from within outwards, the lower fragment by being drawn upwards, presses the upper fragment forwards and outwards. If the plane of the fracture be from before backwards, and from without inwards, the effect of drawing up the lower fragment will be to displace the upper fragment forwards and inwards. According, therefore, to this authority, the displacement of the upper fragment is not so much caused by the action of its own muscles, as by the lower fragment; and the direction in which the upper fragment is displaced, by the drawing up of the lower, depends on the direction of the plane of the fracture. If the fracture be situated at the upper extremity of the shaft, the psoas magnus and iliacus internus draw the upper fragment directly forwards, producing a tumour in the groin; and if the fracture be transverse, and immediately above the condyles, the lower fragment is drawn downwards and backwards by the gastrocnemius externus, plantaris, and popliteus, so that the lower extremity of the upper fragment appears as if it were the part displaced.

Treatment.—After coaptation of the fractured portions, which should be obtained as speedily as possible, the object of treatment is to preserve the parts at rest and properly adjusted; which can be done by attention to attitude and application of apparatus.

Attitude.—Various attitudes have been recommended. Desault advises that the patient be placed on his back on a hard, unyielding mattress, with the trunk, thigh, and leg in a straight line with each other; this attitude he employs partly with a view to give ease to the patient, but chiefly that the muscles may be equally relaxed, and apparatus be easily applied for keeping the limb extended, and at rest.

A second attitude is that proposed by Sir Charles Bell, in which the patient is placed on his back with the trunk raised, the thigh slightly bent on the pelvis, and the leg bent on the thigh.

Mechanism.—This is, likewise, very various. The splint of Desault and also that of Boyer are appliances which were successfully employed by these celebrated surgeons, and although very complicated and cumbersome, and not now employed in this country, yet they were useful on the very same principle as the apparatus now in most general use, and no doubt led to its introduction. The apparatus to which I allude is, in fact, the mechanism of Desault simplified; it has been very strongly recommended by Mr. Liston, and is now generally approved, and adopted in all fractures of the shaft, except those at its very extremities.

This plan of treatment being the same as that recommended for fracture of the neck of the femur, with the single exception that in addition to what is used in that case, a short wooden splint should be applied to the inside of the thigh, it is unnecessary again to describe it. It is of all methods the easiest to the patient; it prevents eversion, shortening, and deformity; and the mechanism is so applied that the pelvis, thigh, leg, and foot constitute one rigid body, which may be moved entire, but the various parts of which being immovable *inter se,* preserve the same mutual relation. Some surgeons object to the treatment above described, if the fracture be at the upper extremity of the shaft and immediately below the trochanter minor, on the ground that—1st. The psoas magnus and iliacus internus muscles having no antagonists, and being put on the stretch by the straight position, will draw the upper part too far forward; and 2nd. The perineal band, if made very tight,—and if it be not made tight it cannot answer the purpose for which it is employed,—will tend to assist the two muscles in increasing this displacement of the upper fragment. In consequence of these objections to the straight position, they advise that the patient be placed in the attitude recommended by Sir Charles Bell for the treatment of fractures of the shaft; but with this peculiarity, that the trunk should be so much raised as to make the patient sit erect for the purpose of relaxing the psoas magnus and iliacus internus muscles; and that four wooden splints be applied, one to the front, another to the back, and one to each side of the limb. If the fracture be so nearly transverse that the upper fragment by pressing against the lower may prevent its retraction, this treatment may answer; but if the fracture be at all oblique, I would recommend the former plan, which I have employed, even in this fracture, with the most satisfactory result. This fracture can be very conveniently and satisfactorily treated in the bent attitude, referred to above, by means of Amesbury's admirable apparatus or fracture-bed for fractures at the upper part of the femur, along with four wooden splints, firmly applied to the front, back, and two sides of the thigh. This apparatus renders it unnecessary to move the patient's body for any purpose, and it has also the great advantage of making it practicable and easy to keep up extension, and thereby to prevent shortening the limb.

In transverse fracture, immediately above the condyles, or in the under third, the preferable attitude is, to have the leg slightly bent, so as to relax the gastrocnemius externus, plantaris, and popliteus muscles, which draw backwards the lower fragment. The most elegant apparatus for the treatment of fracture in this situation, is M'Intyre's splint, which consists of a sandal, and leg and thigh-pieces; the two latter forming a double inclined plane with each other. The thigh-piece is double, the one portion sliding on the other, and can be lengthened or shortened, and firmly fixed by means of a screw. By lengthening the thigh-piece, which can be done without removing it from the patient's body, extension of the thigh can be kept up. The leg and thigh should be included in a roller along with the splint; three short wooden splints should also be applied to the lower part of the thigh, namely, one in front and one on each side, and the roller should be carried up to the upper part of the shaft. By the above means the fractured portions will be kept in apposition and at rest: the whole of the extremity may be moved along with the splint, but the fractured portions will be preserved in contact, and their proper relations to each other effectually maintained. In oblique fracture in the under third, notwithstanding the action of the muscles above referred to, I prefer the straight position, as that in which extension can be most effectually kept up, and shortening and deformity consequently prevented.

OBLIQUE FRACTURE OF EITHER CONDYLE.

Symptoms.—This injury may be recognised by the crepitus which is felt on taking a firm hold of the condyles of the femur, and producing flexion and extension of the knee-joint. The mobility of the condyle is caused by the alternate contraction and relaxation of the gastrocnemius. When the leg is very much bent, a fissure may sometimes be detected. From the extension of the fracture into the joint, it is sometimes followed by inflammation of the knee-joint, and by that means has been known to give rise to serious consequences.

Nature of Displacement.—The vasti muscles passing around the condyles, to be inserted into the patella, prevent great displacement. The fragment, however, has a tendency to be slightly drawn backwards by the gastrocnemius externus; and if the fracture be of the inner condyle, besides being slightly drawn backwards, it is also drawn a little upwards by the adductor magnus.

Treatment.—The same treatment is pursued, whether there be fracture of the external or internal condyle. The extended position is by all preferred, because the head of the tibia, acting as a splint, resists displacement. Pasteboard or gutta-percha splints, moistened in warm water, should be applied by means of a roller. In these injuries, inflammation within the cavity of the joint is much to be dreaded; the use of pressure, therefore, by the above mechanism, must be deferred until all inflammation has subsided. The rule to be observed is to keep the proper attitude from the commencement, but not to apply the mechanism until all danger of inflammation is passed.

FRACTURES OF PATELLA.

Fractures of the patella are either transverse or longitudinal; the former are more frequent than the latter, the exciting causes being more numerous. Fractures of this bone may be either simple or compound; but the compound fracture is fortunately of comparatively rare occurrence.

Fig. 70.

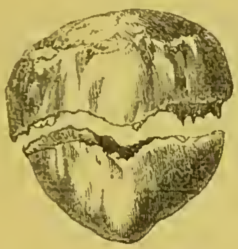
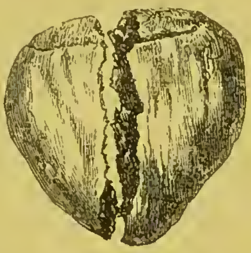


Fig. 71.



Transverse Fracture.—This injury may be produced by direct violence, such as a fall or a blow, or by violent contraction of the four strong extensor muscles of the leg attached to the patella. Persons have been frequently known to meet with this fracture from the last-mentioned cause, while ascending a stair; and the reason of this may be easily understood. The ordinary action of the rectus femoris and triceps extensor cruris is to bring the leg forward; this they do by having their fixed points of attachment above, and they then extend the leg by drawing up the patella, which, through the medium of the ligamentum patellæ, brings the leg forward. In ascending a flight of stairs the action of the muscles is exactly the reverse. When the leg is raised on the step to be ascended, the patella is made the fixed point of the attachment of the muscles, and in the half-bent position in which the leg is placed, the patella rests only by a small part of its posterior surface on the femur, its two extremities, and especially its apex, being unsustained. The four muscles, by their contraction, then raise up the femur, so as to be in a line with the leg, and while they do so, it is evident that the patella has to sustain the whole force of muscular action, together with the weight of the body. The apex of the bone has a tendency to be drawn downwards, and the upper part backwards, by the extensor muscles; so that while the middle part rests on the femur, and has to sustain the whole superincumbent weight and muscular action, if these be too much for the strength of the bone, it snaps, and the muscles having thus lost their under-fixed attachments, can no longer support the body, and consequently it falls backwards. It is a popular mistake that the fall is the cause, whereas it is in fact the consequence, of the accident. This explains the reason why this accident frequently happens to an individual ascending a flight of stairs with a burden on his back. This fracture has also been known to take place during an attack of convulsions, while the patient was stretched on his back; and a case is on record, in which it was produced by placing the body of an individual in the position necessary for performing the operation of lithotomy, and by the straining of the muscles during the operation.

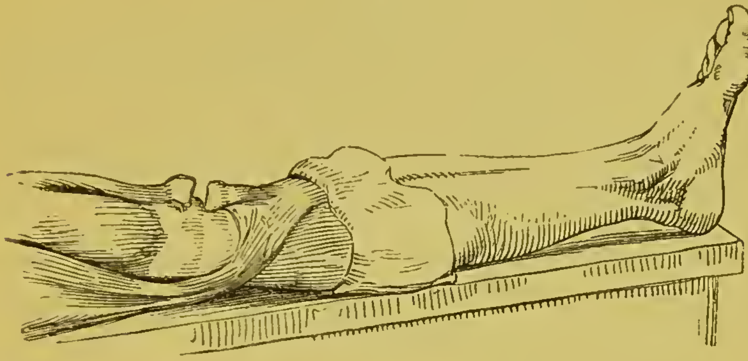
Symptoms.—The fracture may be easily known by the two projections formed by the fragments, and the unnatural depression between them, into which the fingers may be pressed down towards the femur, as far as the integuments will permit. The extent of the depression will depend on the circumstance, whether the ligamentous expansion covering the anterior surface of the patella be lacerated or not. The two fragments are easily movable, but any lateral movement of them is attended with pain. On bending the leg on the thigh, the space between the fragments is increased; it is diminished on bending the thigh and extending the limb. The patient has not the power of extending the leg, or of supporting the weight of the body on that leg, as the knee bends forwards when the weight is placed upon it, from the loss of action in the extensor muscles. The manner in which the patient attempts to bring his leg forwards is also diagnostic; he leans the body forward, and then swings forward the whole of the extremity by calling into action the muscles which bend the thigh upon the pelvis. The nature of the violence, and the tumefaction which quickly follows from the extravasation of blood and secretion of synovia, are indicative of the character of the injury.

Nature of Displacement.—The lower fragment remains in its natural position, and follows, together with the ligamentum patellæ, the motions of the leg; the upper fragment is drawn upwards by the four extensor muscles. The distance of the fragments from each other is increased by the bent position of the leg; but it varies, according as the tendinous expansion from the muscles over the bone is more or less lacerated. If the aponeurosis escape with very little laceration, the separation of the fragments may be limited to a very small extent; whereas, if it be completely lacerated, they may be removed some inches from each other.

Sir Astley Cooper says, that the upper portion may be drawn up five inches, and others have referred to a specimen in the museum of St. Thomas's Hospital, in which the two fragments are connected by a broad structure fully five inches in length.

Mode of Union.—Transverse fractures of the patella are very rarely united by bone, but in almost all cases by a ligamentous substance. It was long supposed that there was something peculiar about the structure of the patella which was unfavourable to the fresh formation of bone. Larrey was the first who questioned the existence of this supposed peculiarity: he ascribed the rarity of bony union to the difficulty of keeping the fragments in immediate apposition; and the correctness of his view, both as to the possibility of union by bone, and the cause of its rare occurrence, is now completely proved.

Fig. 72.



That after fracture of the patella the union may take place by bone, can no longer be denied. In longitudinal fracture of the patella, it is even acknowledged to be the usual mode of union,—so frequently does it occur. In transverse fracture, though it is rarely met with, yet its possibility is incontestably proved. Sir Astley Cooper says:—"In a patient of my kind friend M. Copart, of Paris, I once saw a case which appeared to me to be united by bone; and Mr. Fielding, of Hull, has published a similar case." Sir Charles Bell, in his work "On Injuries of the Spine and Thigh-bone," says:—"This very week a woman goes out of the Middlesex Hospital with a fractured patella united by bone, and you can feel the ridge of union. Admitting that we may be deceived in this, there can be no deception in the preparation, which I place in your hands; you have the patella shattered and reunited by bone, and you perceive the fragments are united with perfect regularity. I have, besides, eight specimens of fractured patella reunited by ligament, and two by bone. The ninth specimen decides the matter. You see that the fracture has not only been across, but that there has been a rent longitudinally." M. Lallement records an unequivocal specimen of union by bone in transverse fracture. It was proved by dissection of the part, after the death of the patient from another affection. Mr. Wilson has found on dissection, specimens of union by bone in transverse fracture; and the collection of Dr. William Hunter is said to contain a well-marked example. On the possibility of bone being formed in fracture of the patella there is now no difference of opinion; and that the cause of its extreme rarity in transverse fracture is the want of correct apposition, appears evident from the following considerations:—

1. Bony union is very common in longitudinal, and very rare in transverse fracture; and it seems difficult to assign any explanation of the difference, except the comparative facility in the one case, and

the extreme difficulty in the other, of preserving the parts in apposition.

2. If in longitudinal fracture the soft parts be so lacerated that it is difficult to preserve the fragments in apposition, then ligamentous union is the usual result. This seems to show clearly that the obstacle to bony union is the want of apposition.

3. In the case recorded by Sir Astley Cooper of Mr. Marryatt, who was thrown from his gig as he was passing along the Strand, there was transverse fracture of the patella; and the lower fragment was also broken perpendicularly, so that the bone was divided into three pieces. The transverse fracture united by ligament, but the perpendicular by bone.

4. In several instances Sir Astley Cooper divided the patella transversely in rabbits, by drawing the integuments to one side, and then placing a knife upon the bone, and striking the knife lightly with mallet. He states, that in no instance in which he performed the experiment, either in the rabbit or in the dog, did he ever succeed in obtaining bony union. He performed the experiment of dividing the bone longitudinally both in the rabbit and the dog; and when the precaution was taken not to divide the tendinous fibres above, or the ligament below, so that the fragments were preserved in close apposition, bony union was readily obtained; whereas, if these precautions were not attended to, the union was ligamentous.

5. Mr. George Gulliver has, in the "Edinburgh Medical and Surgical Journal," related a series of experiments on transverse division of the patella, in which he took care to divide the bone without destroying or interfering with the fibrous expansion in front of it; and, except in one instance, that of an old dog, where the union was ligamentous, the division was followed by perfect ossific union. The fibrous expansion, being uninjured, kept the parts in apposition.

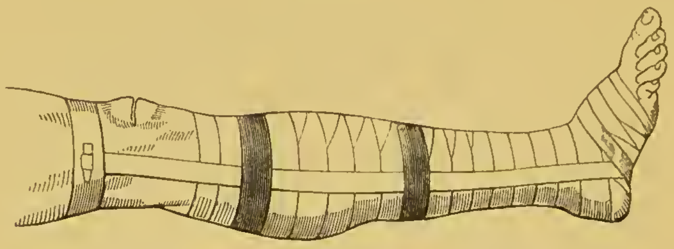
6. I had a case in which there was a crucial fracture of the patella in consequence of a contusion from the explosion of a stone in a quarry. The lateral fragments united by bone, the superior and inferior by ligament.

In longitudinal and comminuted fractures, union readily takes place by bone, but very rarely in transverse, on account of the difficulty of preserving the parts in apposition. When the separation is too great for ossific union, the parts, according to Mr. Adams, who has devoted much attention to this subject, are connected by ligamentous intervening tissue, or by thickened aponeurotic covering of the anterior surface of the bone, according to the extent of separation. When the separation does not exceed an inch and a half, the fragments become connected by fibrous or ligamentous structure, which fills up the space between them, and binds them firmly to each other. When the separation does exceed an inch and a half, the fragments are joined only by the thickened fascia or aponeurosis which passes over the bone; and this aponcurosis has been found to present three varieties of relation to the fragments. It is sometimes adherent only to the periosteal surfaces, sometimes it dips down and has an attachment to the fractured surface of each fragment, and sometimes, indeed most frequently, it passes from the periosteal surface of the upper to the fractured surface of the lower fragment.

Treatment.—The principal indications in treatment are, to relax the four extensor muscles, to subdue inflammation of the joint, if it should occur, and to keep the fractured surfaces as close as possible together by means of mechanism. Attention to the first indication is essential to the fulfilment of the third. It is of the greatest importance carefully to attend to the period at which it is proper to commence the use of means for the attainment of these three objects: for the first, means should be taken as soon as the surgeon has an opportunity of seeing the injury; for the second, as soon as symptoms of inflammation appear; and for the third, not on any account at first, or for several days, lest inflammation should come on, which would be aggravated by the pressure; or, if inflammation has already occurred, not until it has subsided. For the purpose of relaxing the muscles, the trunk should be raised to the sitting posture, so as to relax the rectus; the thigh should be bent on the pelvis; and the leg extended on a line with the thigh, having the heel elevated a little, so as to be higher than the knee, but not much raised, lest the position should be painfully constrained. In this attitude the parts of the skeleton, to which the extensor muscles are attached, are approximated.

For subduing inflammatory symptoms of the joint, leeches, evaporating lotions, and purgatives should be employed; and if the symptoms be violent, venesection, antimonials, and low diet, to an extent proportioned to the age and constitution of the patient. While the above remedies must never be withheld when necessary, they ought always to be used as sparingly as possible, otherwise the energy of the reparative powers will be diminished. For preserving the fragments as closely in apposition as is practicable, various kinds of mechanism are employed, together with the attitude described above. For my own part, I prefer the simple means recommended by Mr. Liston, which I have used in this fracture with as favourable a result as could be reasonably wished. They consist of a simple roller applied from the foot to a little below the knee, to prevent swelling of the leg and foot from infiltration, and a straight wooden splint, hollow at its two extremities and well padded, extending along the back of the limb from a little below the tuberosity of the ischium to a little below the middle of the leg, and retained by a roller, not tightly applied. The fragment of bone connected with the rectus and triceps muscles should be pressed towards the fragment attached to the ligamentum patellæ, before the under part of the thigh is included in the roller. Sir Astley Cooper recommends as the best mechanism for this injury, a broad leather strap, buckled round the thigh just above the knee, from which a long strap descends, passes under the sole of the foot, and is brought up to a buckle on the opposite side of the thigh belt. The leg is enveloped in a roller, and the limb kept extended by a long splint behind the knee. Mr. Amesbury devised an apparatus for transverse fractures of the patella, which has been called the uniting bandage, and consists of two pieces of leather softly padded on the inner surface, and long enough to pass half way round the limb; these are buckled firmly above and below the patella, by straps passing behind the limb. Two short straps, attached to the lower margin of the upper belt, are brought down one on either side of the patella, and buckled to the upper margin of the lower belt, tightly enough to approximate the opposite edges of the pads, and at the same time the two portions of the patella. A long strap is then carried down the outside of the leg from the upper pad, under the sole of the foot, and up the inside of the leg to meet a buckle on the inside of the same pad. A long splint is then applied to the back of the limb. The plan commonly adopted to bring the fragments towards each other is, to apply a circular bandage both above and below the fractured patella, drawing it together by tapes placed between the bandage and the limb. The tapes are tied over the rollers, and the upper fragment is thus kept down. It has been very justly objected to this common method of treatment,—and the objection applies equally to Mr. Amesbury's, and to some others, which it is unnecessary here to describe,—that all belts and bandages tightly applied above and below the fragments must press the extensors attached to the upper fragment towards the femur, and the ligamentum patellæ backwards, so as to sink towards the joint, and thus the upper and lower extremities of the patella are pressed backwards, and the fractured surfaces, instead of being in the same plane, are raised forwards, so as to form an angle with each other. As the under fragment has no tendency to displacement, no advantage whatever can result from pressure below it; but it must be drawn downwards by pressing back the ligamentum patellæ, besides having its broken surface inclined forwards instead of upwards. Mr. Lonsdale

Fig. 73.



From Sir Astley Cooper.

has contrived a very ingenious but rather complicated apparatus, for preserving the fragments in apposition without circular constriction of the limb. M. Malgaigne has been very successful in procuring bony union in consequence of using an apparatus, by means of which the fragments are kept firmly together. It consists of two hooks at each end, which are fixed into the tendinous aponeurosis over each fragment, and are drawn towards each other by means of a screw. It is of the greatest consequence to have the medium of union as short as possible; for if it be of great length, there will be proportionate retraction of the muscles, and consequently diminution of their power, and the patient, after his recovery, will not be able to walk quickly without a halt:—hence the importance of preserving the parts as nearly as possible in apposition.

LONGITUDINAL OR PERPENDICULAR FRACTURE.

This injury is caused by direct violence, and may be easily detected by careful manipulation. Progression is difficult and painful, but not impossible, and re-union by bone is readily effected.

Treatment.—The joint is to be kept extended and at rest, the usual precautions to be taken against the occurrence of synovitis, and the ordinary methods to be adopted if it should occur. After all risk of synovitis is over, a slight lateral pressure is to be kept up, which can be conveniently done by pasteboard splints and a roller, or more elegantly by a pad on each side of the patella, and a laced knee-cap. As a precautionary measure, a straight splint should be applied behind the joint.

COMPOUND OPEN, OR EXPOSED FRACTURE OF THE PATELLA.

This is a very serious injury, and always gives rise to the greatest anxiety in the mind of the surgeon, not merely on account of its being open, which is in itself an unfavourable circumstance, but because the patella being a part of the knee-joint, that large articulation is laid open, and the danger is from the synovitis and its consequences, and the great constitutional irritation, which are apt to result. A wound extending into a joint is at all times a serious injury; and when, as in open fracture of the patella, the joint is not only exposed, but the accident is complicated with injuries of the bone and soft tissues, which must give rise to inflammation, the accident is of a very dangerous character. Such injuries often prove fatal in a very short time, and when this happens, it is usually in consequence of violent irritative fever caused by inflammation of the joint. The inflammation of the joint may prevent any opportunity of performing amputation; for this should, on no account, be attempted, except after the patient has recovered from the collapse caused by the injury before the inflammation commenced; or after the active inflammation and constitutional irritation have subsided.

The conditions which justify amputation are mentioned in speaking of compound fracture in the beginning of this chapter. When an attempt is to be made to save the limb, it should be laid at rest in the position proper for fracture of the patella; the edges of the wound should be brought together as speedily as possible, and every means taken to prevent violent inflammation, and to secure adhesion. When inflammation occurs, it must be combated by the employment of the ordinary antiphlogistic remedies, together with the local use of leeches, and either cold or warm applications, as may be found most grateful to the feelings of the patient. In all cases in which debilitating remedies are required by the character of the injury or disease, the judicious practitioner will always be careful not to employ them to a greater extent than seems absolutely necessary; but in the treatment of inflammation supervening on fracture of the patella, it is especially necessary for the surgeon to remember, that while it is indispensable to use these remedies to an extent proportioned to the urgency of the symptoms and the age and constitution of the patient, care must at the same time be taken that the strength of the patient be not unnecessarily brought down, otherwise the power and energy of the reparative process will be diminished.

Some patients recover with an anchylosed joint, and others, even after a severe injury, with the perfect use of the limb.

Sir Astley Cooper has recorded five cases which were successfully treated. In one of these the recovery was with an anchylosed knee, and in the other four with the perfect use of the joint. One of the cases, a very fortunate one, occurred in the practice of Mr. Ward, of Nottingham:—although the opening into the joint was large, yet, as the patient was young and of good constitution, and as the tibia and femur, and their cartilages, were uninjured, and the soft parts around the wound were not lacerated or contused, so that there was little probability that extensive sloughing would take place, Mr. Ward resolved on endeavouring to save the limb, and the patient recovered the perfect use of the joint, Mr. Ward having afterwards seen him dancing quadrilles at a ball in Nottingham. There is a case recorded by Professor Samuel Cooper, which he saw in St. Bartholomew's Hospital, under Mr. Vincent, where the bone was much fractured and the wound extensive; yet, after the formation of abscesses and the separation of several fragments, the patient recovered with a stiff joint. When I was an apprentice to my friend Dr. Ewing, I had the dressing of a case under his care, in which, in consequence of the explosion of a stone in a quarry, the patella was broken into several pieces, and the joint extensively opened; but as the patient had an uncommonly good constitution, amputation was not performed, and after long confinement and the discharge of a considerable number of small fragments, he recovered the perfect use of the joint. I have, in my own experience, seen two satisfactory recoveries in cases of compound fracture opening into the knee.

FRACTURES OF THE BONES OF THE LEG.

These fractures are very common, as will appear from the following statistics. Dr. Norris, one of the surgeons of the Pennsylvania Hospital, states that during the ten years from 1830 to 1839 inclusive, there were treated in that hospital nine hundred and forty-six fractures, of which two hundred and ninety-three were of the leg. Dr. W. King states that of two hundred and twenty urgent cases of fractures admitted into Guy's Hospital in one year, sixty-six were of the leg; and according to Mr. Lonsdale, of one thousand one hundred and one fractures which indiscriminately presented themselves at the Middlesex Hospital, two hundred and eighty-nine were of the leg. They are the most common of all fractures, except those of the fore-arm, which, according to Mr. Lonsdale and most authorities, are somewhat more frequent. There is not entire agreement among surgeons as to the comparative frequency of the different fractures of the leg. According to Boyer they occur in the following order of frequency:—

1. Fractures of both bones. 2. Fractures of the tibia alone. 3. Fractures of the fibula alone.

This order of frequency, given by Boyer, seems to accord with the experience of Professor S. Cooper; but Mr. Lonsdale found that of two hundred and eighty-nine fractures of the leg, one hundred and ninety-seven were of both bones, fifty-one of the fibula alone, and forty-one of the tibia alone. According to this statement, therefore, the following is the order in which the three classes of fractures of the leg most frequently occur:—

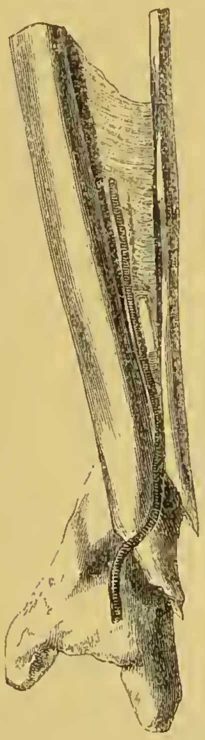
1. Fractures of both bones. 2. Fractures of the fibula alone. 3. Fractures of the tibia alone.

Fractures of the fibula seem to have occurred more frequently than usual in the experience of Dupuytren, who expresses his belief that they are more common than is generally stated, and that fractures of the lower third of the fibula form a third of all fractures of the leg.

FRACTURES OF BOTH BONES.

Causes.—These, which form more than half of all the fractures of the leg, are produced in various ways:—sometimes by a heavy body striking or falling upon or passing over the leg, in which case the fracturing cause acting simultaneously on both bones, it is generally found that they are both broken at the same height; or, by the body falling while the foot is fixed, or by the foot and under part of the leg becoming fixed, while the body is in rapid motion. Another cause of fracture of both bones is a fall or leap from a great height, the person alighting with the extremity extended, and the body erect. The tibia, having to sustain the whole shock, first gives way, and almost always obliquely, and the fibula then receiving the force, next becomes fractured. In these circumstances the fractures are not necessarily at corresponding parts of each bone; for the force being applied to the ends of the bones, each gives way at its weakest part, the tibia frequently about the commencement of its under third, and the fibula within a short distance of its upper extremity.

Fig. 74.



From a preparation in my museum.

Symptoms.—The symptoms which denote a fracture of both bones are,—some change in the direction and shape of the limb, pain, inability to walk or sustain the weight of the body, mobility of the fractured pieces, irregularity perceptible on drawing the fingers along the anterior angle and inner surface of the tibia, crepitus on rotating the foot, and angular deformity on raising the leg. If the fracture be oblique, the heel may be drawn upwards, and angular deformity may be perceptible in front; the cause of which will be explained, when the position of the broken fragments is described. The manner in which the accident occurred will afford presumptive evidence as to the nature of the injury; but the above are characteristic symptoms.

Nature of Displacement.—The displacement may be longitudinal, angular, or rotatory. The longitudinal displacement producing shortening of the leg is extremely rare in transverse fracture; indeed, it can scarcely take place, inasmuch as the drawing up of the under fragments is prevented by the upper portions of the bone; but if the fracture be very oblique, the under fragments may be drawn upwards by the muscles of the back of the leg, and thus slight shortening may take place. Angular displacement may be produced by the action of the extensor quadriceps muscle, by the action of the muscles on the back of the leg, or by the weight of the foot; and in each case the salient angle will be in front. When the bones are fractured near the upper ends—a comparatively rare occurrence, which can only take place as the result of direct violence,—the upper fragment of the tibia is drawn forwards, there being no antagonist to the quadriceps, which is inserted immediately above the fracture. If the knee be bent, the quadriceps muscle will be put more on the stretch, and thus the upper fragment will be still more drawn forwards; hence arises the great importance, in the treatment of this fracture, of keeping the leg extended. The above is the opinion generally entertained regarding the cause of the displacement forwards of the upper fragment in this fracture; but it is objected to by Mr. Key, who remarks, "It is not easy to understand why muscles situated far above the fracture, and sustaining no injury, should be disposed to act on the offensive, while those muscles that act in the opposite direction should be wholly passive on the occasion. It is still more difficult to comprehend, why the extensor quadriceps, lying upon the femur, should be disposed to such inconvenient action as that of perversely drawing the upper portion of a broken tibia forwards; the site of the fracture having no apparent connexion with the muscles to which the displacement is attributed." He supposes that the muscles surrounding the fracture, becoming distended by infiltration, are thereby put upon the stretch and irritated to contract, and that the lower fragment obeying that contraction is drawn upwards, and then pushes the upper fragment forwards. The angular deformity may be caused, as has been stated, by the contraction of the muscles on the back of the leg, or by the weight of the foot, and in either case the projection or salient angle is forward. Under such circumstances, the upper or the lower portion of the bone will project farthest, according to the direction of the plane of the fracture. If the plane of the fracture be from above downwards, and from before backwards, the projecting point will be the upper extremity of the lower fragment; if the plane of the fracture be from above downwards, and from behind forwards, the lower fragment will be drawn upwards by the powerful muscles of the calf, and will push forwards the lower extremity of the upper fragment, which in that instance forms the projecting point. Oblique fractures are very difficult to manage, and the integuments are very apt to be torn by the projecting points of the fragments. Rotatory displacement, called by some authors derangement in the circumference, arises from the inclination of the foot inwards or outwards, but most commonly in the latter direction.

To avoid repetition, the treatment of all fractures of the leg will be described under one head, after the peculiarities of the other two classes of these fractures have been explained.

FRACTURES OF THE TIBIA.

Causes.—This bone may be fractured by direct violence applied to itself, or by a fall on the foot. The tibia is fractured by a fall on the foot in the same way as the radius by a fall on the hand, and the injury in each instance is most likely to take place if the extremity be extended. As the radius receives on its lower part the whole of the shock from the hand, and on its upper part the whole momentum of the body from the humerus, in the same way the lower part of the tibia receives from the foot the whole shock, and the upper part receives from the thigh-bone the whole momentum; and as in each instance a single bone sustains the whole shock, it is easy to understand how the radius in one case, and the tibia in the other, may be fractured without a corresponding injury of the ulna or the fibula. In the lower third it may also be fractured by indirect violence, or by what is called by the French, *contre-coup.*

Symptoms.—Since the fibula, by acting as a splint, prevents shortening, or any particular deformity or alteration in the appearance of the limb, and the extent of the fractured surfaces tends also to prevent shortening and displacement, and since the difficulty of moving the fractured portions on each other renders crepitation less distinct than when both bones are fractured, and the patient has sometimes been known to be capable of supporting his body on the injured limb, diagnosis is more difficult in this than in the former fracture. The manner in which the injury was produced, and pain for some time constant, continuing much longer than that from mere contusion, and increased on moving the limb, are presumptive signs. If the parts be minutely examined, some inequality will be perceived on moving the finger along the anterior angle or inner surface of the tibia; and on taking hold of the ends of the bone, and pushing them in opposite directions, some unnatural mobility, and generally slight crepitation also, will be perceptible.

Nature of Displacement.—If the fracture be near the upper end of the bone, the upper fragment will, for the reason before given, be drawn forwards, especially if the knee be bent; but if the foot be kept in a proper position, it is evident, from what has been already said in describing the symptoms, that there will be little tendency to displacement of the fractured portions.

The treatment will be afterwards described.

FRACTURES OF THE FIBULA.

Causes.—Fracture of the fibula in its two upper thirds, while the tibia remains uninjured, can only be the result of direct violence, and the situation of the fracture will be the part to which the violence has been applied. The deep situation of the bone, the manner in which it is covered by the peronei muscles, and its elasticity, allowing it to yield until it receives considerable support from the muscles between it and the tibia, render the bone capable of sustaining a somewhat powerful force directed against its two upper thirds, without its being fractured. The lower extremity of the fibula may be fractured by direct violence, or by the outward or inward twisting of the foot, or by the body falling to either side, while the foot is confined in a deep cleft; as occurred in the case of Sir Astley Cooper, who says, "I broke my right fibula by falling on my right side, whilst my right foot was confined between two pieces of ice, and I could with difficulty support myself to a neighbouring house by bearing on the inner side of the foot." When the fibula is fractured in its lower third by direct violence, the situation of the fracture is the part to which the violence was applied; but when the fracture has been caused by the inversion or eversion of the foot, it is found to be within three or four inches of the lower end of the external malleolus.

Of the two causes of fracture of the fibula from indirect violence, namely, violent eversion or inversion of the foot, it is stated by Sir Astley Cooper, Mr. Liston, and Professor Samuel Cooper, that eversion is the more frequent; and in this most surgical authorities seem to be agreed; but Baron Dupuytren, in his experience at the Hôtel-Dieu, found inversion to be more frequently the cause of the fracture. It appears that of two hundred cases of broken fibula, a hundred and twenty arose from inversion or rolling the foot inwards, sixty from eversion or rolling the foot outwards, and twenty from direct violence applied to the bone itself. When the foot is twisted outwards, the weight of the body, instead of following the direction of the axis of the tibia, crosses the lower part of the fibula, the ankle-joint, and the malleolus internus in an oblique direction; so that, under such circumstances, it has to be sustained on the outer side and above the joint, by the under part of the fibula, and on the inner side and below by the malleolus internus, and the internal lateral ligaments, while the under part of the fibula is violently pressed outwards by the astragalus. When fracture is caused in this manner, it is frequently combined with fracture of the malleolus internus, or rupture of the internal lateral ligaments.

When the foot is twisted inwards, the weight of the body, instead of following the long axis of the tibia, passes obliquely across the lower part of the tibia, the ankle-joint, and the malleolus externus, the inner aspect of which has the outer part of the astragalus pressed against it, while its under extremity is forcibly drawn inwards towards the outer part of the foot, by the powerful external lateral ligaments:—the rationale of the occurrence of fracture, under such circumstances, may be easily understood.

Symptoms.—There is sometimes considerable difficulty in detecting a fracture in the two upper thirds of the fibula, from the bone being covered with muscles, and there being no shortening of the limb; besides which, the swelling from infiltration often increases the difficulty of tracing the bone, and of detecting crepitus. If the characteristic sign of crepitus be perceptible, either on pressing the bone towards the tibia, or on pressing the foot violently outwards,—by which means it is sometimes discovered, or if another characteristic sign be present, namely, an unnatural yielding, or mobility of the fibula on pressure, there can be no difficulty in forming a diagnosis. In the absence of the above characteristic signs, the surgeon will be guided by the following presumptive symptoms :—the circumstance of the patient having been subjected to the only cause of fracture in this situation, namely, direct force ; a fixed pain at the situation of the injury ; a crack, or sensation of snapping or giving way of the bone having been perceived at the time when the injury was sustained, and a difficulty in walking, sometimes amounting to inability. Pain at the part is generally increased on pressing the foot outwards.

Fracture of the lower part of the fibula is easily discovered. In addition to the presumptive signs of fracture, the nature of the injury is manifested by an inequality of the bone at the broken part, and unnatural mobility of some portion of the lower end of the fibula ; crepitus, perceptible on grasping the leg with one hand, and pressing the foot inwards and outwards with the other ; an angular depression at the situation of the fracture ; distortion, with some unnatural mobility of the foot from side to side, and a change in the point of incidence of the axis of the limb upon the foot. Many of these symptoms disappear, when reduction is effected by force applied to the foot, but they return when the force is discontinued.

Nature of Displacement.—In fractures caused by direct violence, or by eversion of the foot, the lower extremity of the upper fragment, and the upper extremity of the lower fragment, are both drawn inwards towards the tibia, so as to diminish the interosseous space ; but in fractures caused by violent inversion, while the lower extremity of the upper fragment is drawn inwards, as in the other varieties the upper extremity of the lower fragment is drawn outwards, partly from the manner in which the fracture is produced, and partly from the lowest part of that fragment being kept inwards by its attachment to the outer side of the foot by the external lateral ligaments. A fracture caused by inversion is usually nearer the malleolus externus, than one occasioned by eversion.

TREATMENT OF FRACTURES OF THE LEG.

All fractures should be reduced as quickly as possible. To make the description of the treatment of these fractures more clear, they may be divided into two classes :—first, fractures, whether of the tibia, or of both bones, in the upper third ; and secondly, fractures of either or both bones, below the upper third.

I. In fractures of the tibia, or of both bones, which occur in the upper third, or even nearly as far down as the middle of the leg, the pelvis should be raised, and the limb placed in a straight position. If the leg be bent, the quadriceps muscle, by being put on the stretch over the articulation, will cause the under part of the upper fragment of the tibia to press against the common integument ; and if this should not be obviated, there will be great risk of a simple becoming an open or compound fracture, by ulceration of the integument. In this class of fractures, therefore, the straight is the preferable attitude.

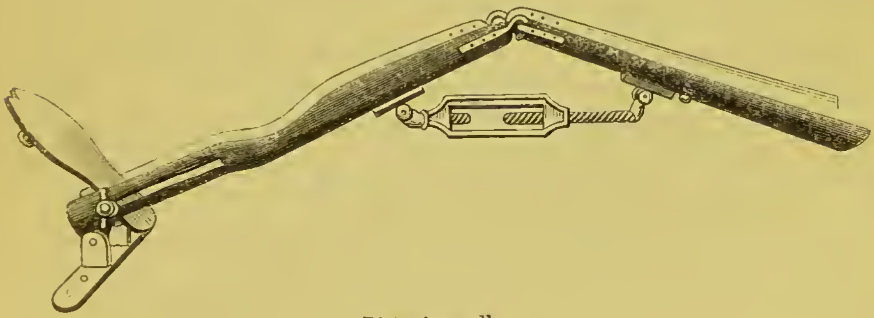
The necessary appliances are very simple, and consist merely of a roller to the foot and lower part of the leg, to prevent swelling from infiltration; a hollow straight splint of wood, extending from the middle of the thigh to near the heel, and two pasteboard or gutta-percha splints for the sides of the leg, together with a bandage for retaining the splints in their proper place.

II. In fractures of either or both bones below the upper third, the treatment must be different, both as regards attitude and mechanism.

Attitude.—The preferable attitude is that in which the leg is bent on the thigh, the degree of flexion being greater or less, as is found most conducive to the easy retention of the fragments in apposition, and in their proper relations to each other, the foot being very slightly extended, and neither inverted nor everted. In this attitude, it will be more easy than in any other to prevent the various kinds of displacement formerly described.

Mechanism.—Various kinds of mechanism have been invented for the treatment of these fractures. The double inclined plane of the late Mr. M'Intyre, of Newcastle, is an ingenious, elegant, and excellent apparatus, and so also is that of Mr. Amesbury, and by means of either of them, all the indications to be fulfilled by mechanism can be readily accomplished; but a much cheaper and equally useful apparatus, is the splint recommended by Mr. Liston, than which a more convenient piece of mechanism for the purposes for which it is intended, could not be desired. It consists of a foot-board of wood, and leg and thigh-pieces of sheet-iron joined to each other by a couple of hooks and a screw. The screw was in use centuries ago, and is represented in the surgical works of Jerome, of Brunswycke, published in the sixteenth century. By it the thigh and leg-pieces may be set to any angle at which it may be desirable to bend the knee, and the foot-piece may be moved upwards or downwards, to suit the length of the limb, and fastened by a side screw, in any position that may be desired. The splint having been adjusted and well padded, the pads being secured by bits of tape, and a sock with a piece of tape opposite to the ball of the great toe, having been put upon the foot, the limb

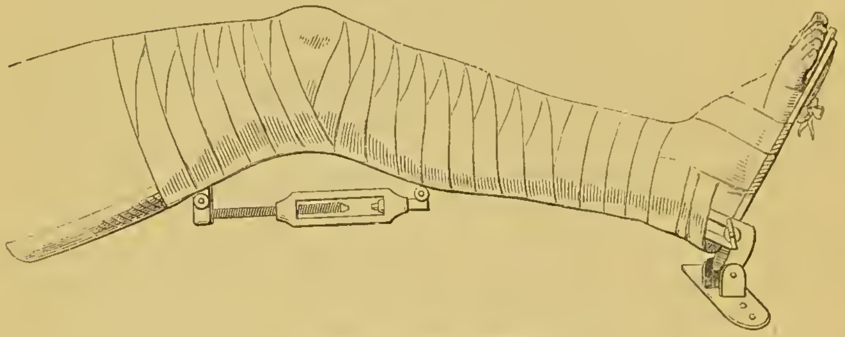
Fig. 75.



Liston's cradle.

is placed on the apparatus, and the piece of tape attached to the sock is fixed to a knob on the surface of the foot-board. The broken ends of the bones having then been placed in perfect contact, and in the desired position, the foot, leg, and thigh should then be secured by a roller commencing at the toes, and carried up so as to embrace the whole of the extremity and apparatus, and also to make some turns round the loins. This will prevent the danger of displacement from any slight motion of the trunk; and although the whole extremity may be moved as one piece, the fragments will always preserve the same relations to each other. The bandage should be made to pass between the screw and the apparatus, and in carrying it round the limb, the greatest care should be taken to adapt it neatly by reverses, where inequalities of the limb would cause it to lie unevenly. For favouring the return of blood, and diminishing the danger of swelling, the extremity should be raised a little above the level of the trunk, while the patient remains in bed. In general, it is unnecessary to confine the patient for more than eight or ten days; after this he may be allowed to sit up during most of the day, with the heel on a level with the pelvis. The treatment thus goes on pleasantly, without danger of the general health being injured by long confinement to bed. By occasionally turning the screw very slightly, passive motion is given to the knee, and the danger of stiffness is obviated. In six or eight weeks, as consolidation has advanced, the time for which varies according to the age, strength, and constitution of the patient, the apparatus may be removed, and the patient allowed to move on crutches: he must be careful, however, not to put any weight on the limb for several weeks, otherwise, however straight the leg may be, on the removal of the apparatus, it will become bent and deformed. After the removal of the apparatus, gentle support should be given to the leg by means of the starched bandage, or by pasteboard splints and a common roller. A more convenient or successful method of treatment than the above need not be desired.

Fig. 76.

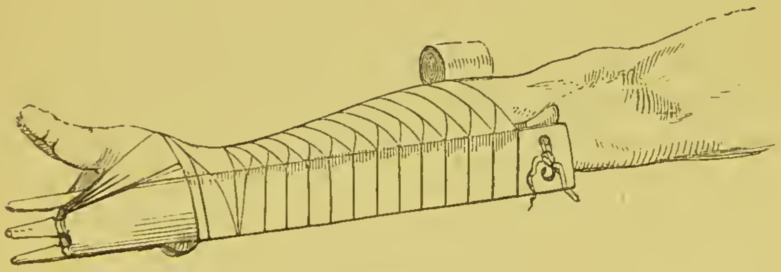


Liston's splint applied.

In the absence of the more perfect apparatus, the fragments may be preserved in their proper relations to each other by means of the common wooden splints for the leg, retained in their position by loop or buckle bandages. In fractures of both bones, each splint should have a foot-piece; but in fracture of a single bone, it will be sufficient if a foot-piece be attached to the splint on that side to which the foot has a tendency to turn. The splints should be well padded with wadding, cotton-wool, or tow, to prevent painful pressure on the soft parts.

Fractures of either malleolus, or of a single bone, near its lower extremity, can be conveniently treated by the simple apparatus so strongly recommended, and successfully employed by Dupuytren. When slightly modified, it consists of a straight wooden splint, a pad, thicker at the end nearest the ankle, and a roller. The splint should be long enough to extend from the head of either bone of the leg to three or four inches beyond the foot, and have two retiring angles or notches at its extremity, and perforations at its upper end to admit pieces of tape, by which a pad is affixed to it, and also to receive the split end of the roller. It should be applied to the side of the leg opposite to that to which the foot has a tendency to turn, the one extremity extending upwards to near the knee-joint, the other to three or four inches beyond the foot. The pad should be between the leg and the splint, with its thicker end between the latter and the foot; and the roller should be fixed to the upper extremity of the splint by passing the two parts of its split end through the perforations, and securely fastening them together. This will prevent the splint from being pressed upwards. The roller then, embracing the leg and splint from above downwards, should, during its convolutions round the foot, be made to pass through the retiring angles or notches in the extremity of the splint, whereby it will keep the foot from being displaced in the direction in which it is turned by the accident, and the thick end of the pad acting as a fulcrum, and keeping the splint removed from the foot, will enable the bandage to act with greater effect. In this method of treatment suggested by Dupuytren, the bandage offers the resistance to displacement of the foot, and the splint should always be placed on the side opposite to that to which

Fig. 77.



From Liston.

the foot has a tendency to turn; whereas in the treatment with the common splints for the leg, which some British practitioners still employ, the splint with the foot-piece offers the resistance to displacement, and it should always be on the side to which the foot is displaced. In the latter method the resistance to displacement is offered by the splint with the foot-piece, in the former by the bandage; in the latter, the splint with the foot-piece is always applied to the side to which the foot is displaced; in the former, the single splint is always placed on the opposite side.

A most satisfactory way of treating simple fractures of the leg is by means of pasteboard splints, together with starch bandage, or by starch bandage alone. The period for application is after the subsidence of the swelling and slight inflammation that usually follow the injury. A great advantage of this method is, that such an encasement is formed round the limb as serves to remove all danger of displacement, and makes it unnecessary to confine the patient for any great length of time to the recumbent posture. Nothing could answer better than this mode of treatment, when resorted to at the period mentioned above.

Of the practice, recently adopted in Belgium, of applying the starch bandage immediately after the occurrence of the injury, and thus forming an incasement for the limb, the results are said to be satisfactory; and individuals, who have witnessed there this mode of treatment, have given very favourable accounts respecting it. Some time ago I went to Brussels for the purpose of satisfying myself, by personal observation, as to the results of this proceeding; and certainly nothing could be more satisfactory or gratifying than what I saw of this practice in the hospitals in Brussels. I have since treated cases by this method, when called to them sufficiently early; and my experience leads me to conclude that, in fracture unattended with any complication, and seen immediately after the injury, it is an excellent method of treatment. The patient, however, must be very carefully watched; and if any tension be complained of, a portion of the bandage must be divided by means of a pair of strong scissors, but without disturbing the general incasement of the limb. By this method of treatment the patient is soon allowed to sit up, and the general health in consequence is in no danger of being impaired.

FRACTURE OF THE RIBS.

Fractures of the ribs happen almost as frequently as those of any other bone in the body. From the statistics of Mr. Lonsdale, it appears that, out of one thousand nine hundred cases of fractures admitted into the Middlesex Hospital, thirty-five were fractures of the ribs. The middle ribs being the longest and most exposed to violence, are most liable to fracture. The upper ribs being the strongest, and protected by the clavicle and the pectoral muscles, are rarely fractured. The lower ribs generally escape injury in consequence of their being short, mobile, and free at their anterior extremities.

Exciting Causes.—This accident is produced in one or other of three ways :—either by direct violence, as a blow, or fall ; or by the application of force to the sternum or anterior extremity of the rib ; or by muscular action, as in coughing, in persons of a cachectic habit of body. If a rib be fractured by direct violence, the part where the violence was applied is the site of the fracture. If the second exciting cause mentioned produce fracture, the rib gives way at its most convex point—a little anteriorly to its angle.

Symptoms.—A fracture of a single rib, unattended with any internal lesion, is an injury of little moment, the patient commonly recovering in the course of four or five weeks ; but when several ribs are broken, and there is, connected with the injury, one or more of the complications hereafter specified, the case is one of a very serious nature, and such as often terminates fatally. A simple fracture is often capable of detection by merely passing the finger over the suspected part. The more elegant mode of examination is, to place the hand upon the injured part, and to desire the patient to make a full inspiration, or to cough ; when, if a fracture be present, a crepitus will be perceived, and the patient will experience great pain, from the ends of the bone grating upon the soft parts. This latter symptom is much increased by any exertion of the respiratory organs, as sneezing, coughing, &c.

Absence of Thoracic Respiration.—On account of the pain which attends the motion of the rib, the patient avoids thoracic respiration, and calls into action the diaphragm and abdominal muscles.

Nature of Displacement.—It is necessary to attend to the direction of the salient, or pointed angle. It is obvious that the displacement of the ends of the fractured rib can only be either inwards or outwards, for the intercostal muscles preclude the possibility of their assuming an upward or downward direction. If a rib has been fractured by direct violence, the direction of the retiring angle will be outwards, and of the salient angle inwards ; on the contrary, if the injury has been produced by violence, applied to the sternum or anterior extremity of the rib, the direction of the retiring angle will be inwards, and that of the salient outwards : in fact, the disposition of parts is just the reverse. The former kind of displacement is the more dangerous, because the pleura and lungs are apt to be wounded. If there be a mere fissure, there is no displacement.

Treatment.—This consists in keeping the rib at rest as much as possible, by means of a broad bandage of calico or flannel, applied round the chest so tight as to stop thoracic respiration, and to make the diaphragm and the abdominal muscles aid in the performance of the respiratory action. If the ends of the fracture project into the cavity of the chest, a large compress is to be applied in front of the sternum, and in this manner the convexity of the rib is increased. If they incline outwards, the modification of the treatment consists in placing two large compresses, one on each side of the fracture. It is convenient, in order to prevent the broad bandage from slipping down towards the loins, to attach a split cloth, or a scapulary to its central part posteriorly, and, passing it over the shoulders, to secure it in front. Instead of the bandage already described, a belt of webbing or girth, furnished at one end with four or five buckles, and at the other with as many straps, as also with two shoulder-straps to prevent displacement, is sometimes employed to suspend the movements of the chest in respiration. It is more compact and effective than the common bandage, and is called a fractured rib bandage. To prevent the occurrence of inflammation within the chest, it is expedient, if the patient be very plethoric, to take blood from the arm.

Fig. 78.

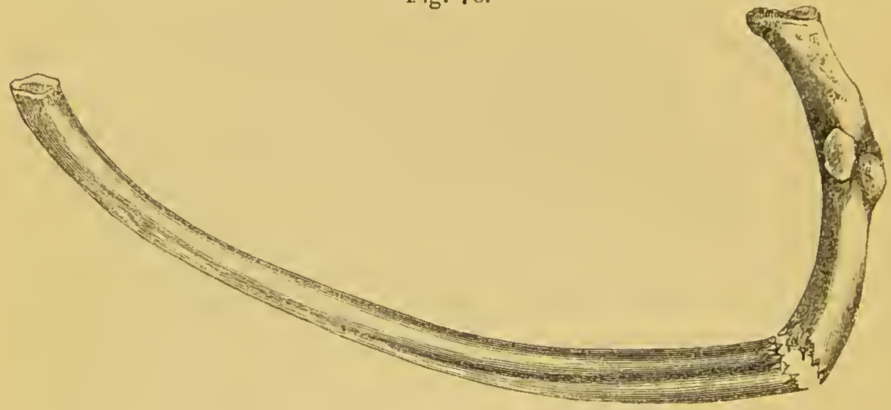
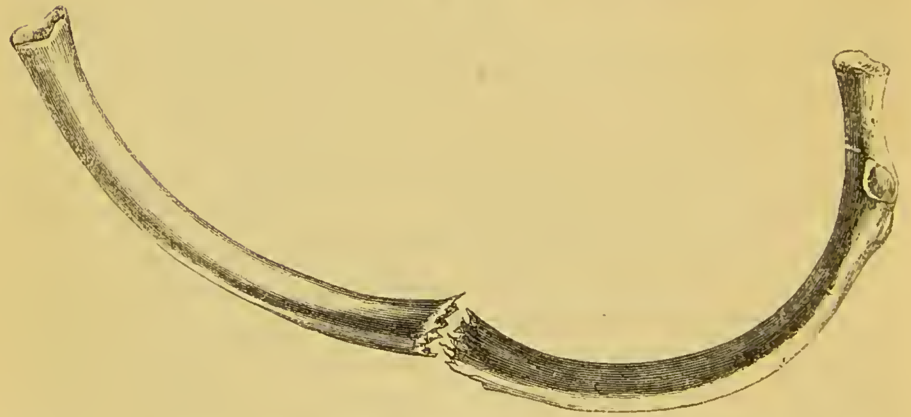


Fig. 79.



PARTICULAR COMPLICATIONS.

General Emphysema, or inflation of the subcutaneous cellular tissue of the body.

Symptoms.—These are—difficulty of breathing, a preference of the erect attitude to the horizontal, great distension of the cellular membrane, pitting and crackling on pressure of the swelling, and, if the emphysema be very great, a hissing noise on cutting the skin, arising from the escape of the air.

Condition of Parts.—Rupture of the pleura and a portion of the lung, from the ends of the fractured rib projecting into the cavity of the chest, is necessary to produce this condition. The air is effused into the chest, escapes into the cellular tissue around the fracture, and by the contraction of the chest in respiration, is forced into the general cellular tissue; because the air has no outlet, the skin being entire. We say, therefore, that general emphysema, in fracture of the ribs, is the result of an unnatural communication between the air-cells of the lung and the cells of the subcutaneous cellular tissue. If this condition prove fatal, it is by way of asphyxia, the great distension of the cellular membrane mechanically compresses the thorax, so that the muscles of respiration being overpowered, are incapable of dilating the chest. The difficulty and imperfection of respiration are indicated by the lividity of the face, lips, and eyelids, the dilatation of the nostrils, and the coldness of the extremities for some time previous to dissolution.

Treatment.—A few deep scarifications should be made over the sternum and the ribs, when the air will escape, and the swelling gradually disappear.

Pneumothorax, or accumulation of air sent from the air-cells of the lung into the cavity of the pleura.

Symptoms.—In a well-marked case, on looking at the thorax, it will be observable that the affected side of the chest is longer, from the ribs being more or less separated, larger, circular, and almost motionless during respiration. Auscultation supplies another symptom, namely, the complete absence of the respiratory murmur, except at the roots of the lungs, that is, between the scapula and the spine.

On percussion, the affected side yields a clearer sound than the other. This symptom, together with the greater size of the affected side, might lead one to consider that as the sound, and the healthy as the diseased side.

Treatment.—Generally a slight degree of inflammation takes place, which seals up the air-cells, and the air is absorbed. The circulation of the lungs should be kept as low as possible, and antiphlogistic remedies had recourse to. Sometimes, however, the operation of paracentesis is necessary.

Interlobular Emphysema, or infiltration of air into the cells of the cellular tissue of the lung.

Condition of Parts.—This affection is produced by rupture of some of the proper air-cells, and the consequent extravasation of the air contained in them into the cells of the cellular substance of the lung. The cells of the cellular tissue, thus distended with air, compress the air-cells and vessels of the lung, in consequence of which the circulation of air through the air-cells, and of blood through the pulmonary vessels, becomes interrupted, and the portion of lung is rendered incapable of performing its function. The air in the cellular tissue does not undergo change; consequently it can have no beneficial effect upon the blood in the lung, and by means of the distended cellular tissue, septa form, which isolate a portion from the rest of the lung. These septa, by rasping against the parietes of the thorax, produce the friction of ascent and of descent, which are indicative of this condition of lung.

Symptoms.—On exposing the thorax we observe, that the affected side is less movable during respiration, not contracting and dilating as in the normal state. If the affection be very great, there will be a slight increase in the length and size of the affected side.

On percussion over the site of the emphysema, the chest sounds somewhat more clearly than natural, but not to such extent as in pneumothorax. The nearer the injury is to the surface of the lung, the more distinct the resonance will be. Auscultation furnishes another sign completely pathognomonic of this affection, namely, the crepitus ronchus with large bubbles. This sign, which is more marked during inspiration than expiration, resembles the noise produced by filling a dried bladder with air. Connected with this sign we usually perceive the friction of ascent, and the friction of descent, the former accompanying inspiration, the latter taking place during expiration. The impression communicated to the ear is that of some hard dry body, rising and falling, and rasping against the thoracic parietes, and is particularly discernible just as expiration ends, and before inspiration commences. Sometimes this sound is perceptible in the under part of the thorax in the neighbourhood of the diaphragm, sometimes in the situation of the mediastinum. In some instances this sound is continuous during inspiration and expiration; in other cases there is a succession of sounds. Besides the symptoms already mentioned, there are others of a general and local kind, as dyspnœa, more particularly on making any exertion, slight lividity of the countenance, coldness of the extremities, and occasionally emphysema.

Treatment.—This affection is attended with danger, and all that can be done is, to keep the circulation of the lungs as quiet as possible. With this view, lay the patient in bed, enjoin low diet and the usual antiphlogistic remedies. Sometimes nature seals up the cells with lymph, and the air is absorbed, and the cellular substance surrounding the lobules assume their healthy condition.

HÆMATHORAX, or effusion of blood into the cavity of the pleura from rupture of some of the intercostal vessels, and perhaps of those in the substance of the lung.

Symptoms.—Impeded respiration from obstruction to the motion of the lungs, is one of the most marked symptoms of this affection.

Percussion yields the dull sound, from blood being interposed between the thoracic parietes and the lung. The stethoscope indicates the absence of the respiratory murmur, except at the root of the lung; and before the effused blood be coagulated, there is sometimes heard a silvery sort of echo of a sharp and shrill tone, termed ægophony, the impression communicated being that of a voice heard within the thorax. The voice is reverberated in the bronchial tubes, and is conveyed to the surface of the chest by the compressed lung and the extravasated blood. The presence of a fluid seems to be one of the most essential conditions for the production of this phenomenon, and consequently it can exist only before the blood is coagulated. The features become pale, and all the symptoms of internal hemorrhage appear.

FRACTURE OF THE STERNUM.

The sternum is sometimes fractured, but not so often as might be expected from its exposed situation. From its position between the elastic cartilages of the ribs it escapes any ordinary violence. A fracture of the sternum is sometimes followed with serious consequences, as necrosis, or abscess immediately behind it.

Symptoms.—This injury is easily detected by the crepitation which is felt on applying the hand to the front of the chest, and desiring the patient to make a full inspiration. The function of respiration is principally performed by the diaphragm.

Treatment.—The patient should be placed in bed, with the head bent forwards and the pelvis slightly elevated in order to relax the sternomastoid and the abdominal muscles. If this be not attended to, an angular deformity, having the salient angle directed forwards, will result. With the view of keeping the fragments at rest as much as possible, some apply a large soap plaster over the ribs, others employ a broad bandage, as in fracture of the ribs, which is unquestionably the right proceeding.

FRACTURES OF THE PELVIS.

These are of rare occurrence, on account of its peculiar shape and the great thickness of several of its bones.

Exciting Causes.—Falls from a great height upon the pelvis, the passage of heavy bodies, as a cart or waggon, over it, and falls from or under a horse, are the ordinary exciting causes. Fractures of the ossa innominata, especially if deep-seated, are with difficulty detected; but the nature of the injury can generally be ascertained from the history of the case, and the inability of the patient to support himself in the erect position. There is also a feeling of laceration at the seat of the injury, on the patient making any exertion.

It often happens as a serious consequence of fractures of the pelvis, that the bladder is lacerated and the urine escapes. If the laceration be in particular situations, the urine escapes into the peritoneum, speedily producing peritoneal irritation and death; and at other times, and more frequently, the urine is effused into the cellular tissue about the pelvis, giving rise to sloughing of the parts and extensive abscesses. Fracture of the sacrum is often attended with compression of the sacral nerves, and consequently with paralysis of the lower extremities. Fracture of the os coccygis can be ascertained by careful manipulation, or by introducing the finger into the rectum, by which means apposition of the parts may be also produced.

Treatment.—With respect to treatment of fractures of the pelvis, one precaution never to be delayed, is the introduction of a catheter into the bladder, which should be allowed to continue there a considerable time, in order to diminish the danger of extravasation. The patient should be placed in a very soft bed, in the easiest position, and the lower extremities tied together to prevent any motion.

If inflammation succeed, it must be combated by the strictest antiphlogistic treatment which the powers of the patient will permit; and after some time, a broad belt may be placed around the pelvis, so as to keep the parts at rest.

In the union of a fracture of the sacrum, there is sometimes a considerable quantity of callus thrown out, which may prove inconvenient.

FRACTURES OF THE SPINE.

It very rarely happens that one vertebra is broken; two or more are generally involved in the injury. The vertebral column contains and protects the spinal cord, which gives off the nerves that preside over sensation and voluntary motion.

Exciting Causes.—These are two: direct violence to the vertebral column, and falls from a great height upon the head, the head being at the time bent forwards. When the latter is the exciting cause, the appearance presented by the spine is the same as in excurvation, or posterior curvature of the spine.

Symptoms.—These vary very much, and depend upon the situation of the fracture and its effects upon the spinal cord. If a fracture take place in the lumbar region, and if, in addition to the fracture, there be pressure upon the spinal cord, arising from displacement, effusion, or extravasation, there will follow loss of sensation, involuntary expulsion of the fæces, retention of urine, together with a sense of pain and weakness, and a degree of irregularity at the seat of injury. The inability of the patient to retain the fæces arises from the sphincter muscle, which receives its nerves from the spinal cord, being paralysed.

Rationale of the Retention of the Urine.—The bladder being paralysed, cannot pass off the urine ; hence the retention. This retention of urine, as pointed out by Desault, if the patient do not die, is followed by a sort of dribbling, or incontinence of urine.

The explanation of this latter circumstance is, that the bladder becomes so enormously distended, that the urine forces open the commencement of the urethra to such an extent as to allow a small quantity to dribble off, yet not sufficiently to relieve the retention or obviate the necessity for the introduction of a catheter. A symptom which occasionally takes place at the time of the injury is priapism, and even emission of the semen, which Mr. Lawrence remarks, has never been satisfactorily explained. Notwithstanding the presence of these symptoms, the functions of organic life, as heat, secretion, and circulation, still continue. If a fracture with compression occur at the upper part of the lumbar region, the whole of the symptoms already mentioned will be observed, with the addition of a tympanitic condition of the abdomen, produced by the sudden distension of the intestines with gas. If the patient do not soon die, this symptom sometimes disappears after a smart purging. If a fracture happen in the upper part of the dorsal region, together with pressure upon the spinal cord, the additional symptom is, absence of thoracic respiration, arising from pressure upon the spinal cord above the origins of the intercostal nerves.

If the fracture be as high up as the sixth cervical vertebra, and attended with pressure upon the spinal cord, there is paralysis of the superior extremities.

When a fracture, attended with compression of the cord, takes place above the third cervical vertebra, it is instantly fatal. The phrenic nerves supply the diaphragm, and instant death is the result of pressure upon the spinal cord above their origins. The period at which the patient dies, varies according to the different situations of the accident, and the extent of pressure upon the cord.

Death is not the immediate result of fracture, even above the third cervical vertebra, unless it be attended with displacement. When a fracture is lower down, between the fourth cervical and the first dorsal, the patient generally lives from three to ten days. When the dorsal region is the seat of fracture with compression, the patient may live from two to three weeks. If a fracture occur in the lumbar region, the patient may perhaps live from three to eight weeks, occasionally some months, as in a case recorded by Mr. Harold, of Cheshunt.

Treatment.—Little can be done. The patient should be placed in the easiest attitude, and the broken ends of the column kept at rest. Antiphlogistic treatment, both general and local, especially local depletion by leeches, may be necessary to prevent and subdue inflammation. The state of the bladder must be particularly attended to, and the catheter introduced, if necessary. If the immediate effects are not fatal, counter-irritants may be locally applied, but their use should be delayed for some time.

Concussion of the spinal cord may lead an individual to suppose that compression exists, when it really does not. Here counter-irritation in the chronic stage is very beneficial. The application of strychnine is then often attended with the happiest results. The best mode of using it is, to apply blisters, about the size of a crown-piece, and, when the cuticle is removed, to throw one quarter or one half a grain of the powder of strychnine over the blistered surface. The operation of trephining for the purpose of removing pressure from the spinal cord, has been proposed and performed: success, however, does not seem to have attended the operation, or to encourage a repetition of it. Upon this point Sir A. Cooper remarks, "Mr. Henry Cline was the first person who attempted to give relief in this accident. Being an excellent anatomist and a most able surgeon, he saw no reason why cases of this kind should not be treated as cases of fracture with depression of the skull. Accordingly he cut down upon the arch of the spinal marrow, where the compression was greatest, and with a small trephine of his own invention, he sawed through the arch of the spinous process, and took off the pressure on the spinal marrow by raising the depressed portion of the arch.

"It is right, however, to mention that, in many of these cases, the spinal marrow is itself torn through. In some cases of fracture, with displacement, it is completely torn; in others, partially; and in some not at all. In cases where it has not been torn, there would be hope from such an operation; and it is in these cases that the operation has been performed. Mr. Tyrrell has attempted the operation since Mr. Cline; but both cases have terminated unfavourably. Whether future experiments may be attended with better success, it is impossible to say."

"It has been proposed," Mr. Liston observes, "to treat the spine, in cases of severe and alarming fracture, in the same manner as the cranium, by trephining; and some have recommended this in almost all kinds of injuries. I allude to the practice, only to condemn it. The spinal chord is generally displaced and compressed by the lower portion of the fractured body of the bones. One cannot easily comprehend what an operation is to effect in such cases: further notice of this proceeding is unnecessary, seeing that, as far as I know, it has been unanimously discarded by the profession from amongst the list of surgical operations." Mr. Lawrence remarks, "The great objection to this proceeding is, the uncertainty respecting the precise seat of injury, and the precise mode in which the spinal cord has been injured, or continues to suffer pressure. It is an operation which, if it were done when the contents of the spinal canal were perfectly uninjured, would, I think, be likely to be followed by inflammation of the membranes and cord; it would be likely to produce mischief, even if no mischief had existed before. For these reasons it appears to me, that the proposal of taking out the spinous processes of one or two of the vertebræ ought not to be entertained."

FRACTURES OF THE FACE.

FRACTURE OF THE BONES OF THE NOSE.

Causes.—Owing to the prominence of the nose, the nasal bones are much exposed to fracture. It generally requires considerable force to break the arch formed by the articulation of the nasal with the superior maxillary bones. Direct blows, or severe falls, are the most common causes of the accident.

Symptoms.—In many cases the contusion of the neighbouring soft parts is so great as to produce great swelling, and diagnosis is not always easy immediately after the fracture; but even if crepitus cannot be distinguished, the mobility of the parts will often be characteristic. Bleeding from the nose, and injury of the brain, may also be present. The injury of brain is apt to be from concussion, rather than from compression. If the inflammation be great, there may be exfoliation of the bones of the nose, or the inflammation may extend to the dura mater, which will produce deep-seated pain in the neighbourhood.

Nature of the Displacement.—If the fracture is simple, the displacement would be slight, and but little deformity would result; but if the bones are crushed, the bridge of the nose will be destroyed.

Treatment.—This will depend upon the amount of inflammation and the displacement. Should the fracture be simple, antiphlogistic measures may be all that is necessary; but if the bones are crushed and pressed in, they must be adjusted by a large probe, or a female catheter. Compresses applied on each side of the nose, may be of use in retaining the fragments in apposition. Stopping up the nostrils with plugs of lint, or any other material, will be found of no service; on the contrary, they will be more likely to do harm by increasing the inflammation.

FRACTURE OF THE MALAR BONE.

Causes.—This bone is rarely fractured, unless from great violence, which will also produce great contusion of the soft parts. It is easily recognised, unless the swelling be very great.

Treatment.—The swelling and inflammation are to be removed by appropriate remedies. The jaw must be kept perfectly quiet, which can be best effected by Barton's bandage for fracture of the lower jaw. The patient should not speak nor masticate. Should fragments of broken bone be driven into the temporal muscle, which would interfere with chewing, it might be necessary to cut down upon the fracture and elevate the pieces of bones.

When small portions are split off from the edges of the malar bone, they are frequently reduced in size, by absorption, previously to their uniting.

FRACTURE OF THE UPPER JAW.

The superior maxillary bone is sometimes fractured at its nasal process, in connexion with fractures of the nose. Its alveolar processes are also liable to fracture, though the injury is not a serious one, unless it is the result of a gun-shot wound involving the antrum Highmorianum.

Fragments of alveolar processes will sometimes unite if properly pressed to their place, and the jaw be kept at rest.

Fracture involving the antrum, would be attended with great swelling and pain, and the inflammatory symptoms would require antiphlogistic remedies.

FRACTURE OF THE LOWER JAW.

This results from direct violence, which must be very considerable to produce a fracture in a bone which is so strong and at the same time so mobile. The seat of fracture may be in the body, rami, or processes, and it may happen that the fracture will occur at the symphysis, although this is rare even in children. The direction of the fracture may be either vertical, horizontal, or oblique. A portion of the alveolar process may be broken, without any serious inconvenience. The most frequent situation of the fracture is between the symphysis and the insertion of the masseter muscle.

Symptoms.—There is no difficulty in the diagnosis. The history of the case, the pain upon moving the jaw, the unevenness of the base, the irregularity of the teeth, and the crepitus, are sufficient. The larger fragment, to which the chin is attached, will be found to be drawn downwards. If the fracture is double, the displacement will be greater, and the middle portion, or chin, will be drawn downwards. The gums are frequently lacerated, and bleed.

When fracture occurs in the neck of the condyloid process, it is not so easily recognised. It is to be distinguished by the pain near the ear, by crepitation, and by the condyle being drawn forward by the action of the pterygoideus externus muscle.

Treatment.—The fragments are generally coaptated without difficulty in single fractures; but in double fractures, more care is required. In either instance, the great object is to keep the lower jaw firmly pressed up against the upper, which acts as a splint. A simple dressing consists of a moistened bit of pasteboard, moulded to fit the jaw, and secured by a four-tailed bandage, which has a slit in its middle, into which the chin is placed. The two upper tails are to be tied behind the neck, and the two lower ones upon the crown of the head. In young persons, and in double fractures, it will sometimes be found convenient to fasten the teeth together with strong silk, or fine silver wire. In many cases it will be sufficient to place a large, thick compress under the chin, and apply Barton's bandage. This consists of a roller, five yards long and two inches wide. "Place the initial extremity of the roller upon the occiput, just below its protuberance, and conduct the cylinder obliquely over the centre of the left parietal bone to the top of the head; thence descend across the right temple and the zygomatic arch, and pass beneath the chin to the left side of the face; mount over the left zygoma and temple to the summit of the cranium, and regain the starting-point at the occiput by traversing obliquely the right parietal bone; next, wind around the base of the lower jaw, on the left side, to the chin, and thence return to the occiput along the right of the maxilla; repeat the same course, step by step, until the roller is spent, and then confine its terminal end."

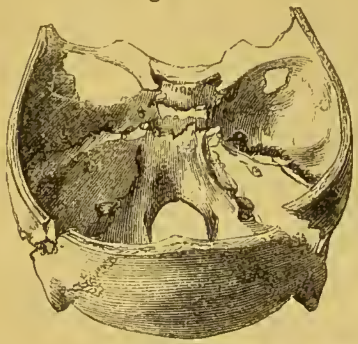
If the parts are kept perfectly quiet, union takes place readily in four or five weeks, there being abundant vascular supply; and usually no deformity results. The patient is to be nourished by fluids, and there is usually room enough for soups and gruels to find their way into the mouth through the interstices of the teeth. Some surgeons recommend the introduction of thin pieces of cork on each side between the molar teeth, leaving an aperture between the incisors sufficient for the introduction of food or medicine by a small spoon.

FRACTURES OF THE CRANIUM.

Causes.—From the manner in which the different bones of the cranium are arranged, an ovate or spheroidal box is formed, which resists external violence, after the manner of arches, according to Bertin, and of spheres, according to Béclard; yet it is frequently fractured, and in the majority of instances, these fractures are produced by the direct application of force to the injured part, as when a person is struck or falls upon the head, and the bone is broken exactly where the blow or fall was inflicted. The cranium, however, does not always give way where it was struck, but sometimes at a distant part, forming the *fracture by counter-stroke* of the British, the *fracture par contre-coup* of the French authors.

Fractures of the base of the cranium, in the great majority of instances, are caused by counter-stroke; the reason of which is easily explained. If a great weight fall upon the top of the head while the body is erect, or if the top of the head be struck by an obtuse body, the force thus applied above has a tendency to produce expansion of the lateral parietes, and to force the base of the cranium against the apex of the spinal column. It is evident that in such circumstances the cranium is acted upon by two forces: the violence applied to the top of the head acting downwards, and the resistance offered by the vertebral column acting upwards, so that a fracture of the base is often the result. In like manner, when in falling from a great height, the top of the head or vertex comes to the ground, the resistance of the ground acts on the top of the head; and the whole momentum acts through the medium of the spinal column on the base. The cranium being thus included between two forces, gives way at its weakest part, that part being the base. Sometimes, however, fractures of the base are produced without a fall or a blow on the head itself, as when a person falling from a great height alights upon the nates; the spinal column being thus brought suddenly into a state of rest, offers resistance to the head, which being still in projectile motion, has its base forcibly driven against the spine, and a fracture may be the result. In each of these three cases, the head is acted upon by two forces with greater or less violence.

Fig. 80.



Fracture across whole base of skull, produced by a fall on the crown of the head. The patient was admitted into my wards in the Royal Infirmary. From a preparation in my museum.

Sir Benjamin Brodie, in a very interesting paper on Injuries of the Brain, says—"It has been observed to me, however, by Mr. Earle, that he has not known a fracture of this kind (*i.e.*, by counter-stroke) to take place, except when the blow seems to have operated in such a manner as to impel the occiput forcibly against the atlas, the line of fracture passing through the former bone, where it rests on the latter. My own experience corresponds very nearly with that of Mr. Earle. The only well-marked cases of fracture of the cranium, in which the fracture could be attributed to the effects of *contre-coup* which have fallen under my observation, were similar to those he has mentioned."

Fractures of the base of the cranium are not invariably caused by *counter-stroke.* Sometimes, when violence is directly applied to the occiput or the lateral parts of the cranium, it is not only sufficient to produce fracture of the part to which it is applied, but also to extend the fracture to the base. Of this I have seen two instances:—one, in which the fracture extended forwards to the body of the sphenoid bone, in consequence of a fall on the occiput; and the other, in which it extended along the whole base of the skull, in consequence of a kick from a horse on the mastoid process.

Of fractures of the cranium it may be observed, that those of the base in most instances result from counter-stroke, while those in other situations are invariably occasioned by direct violence.

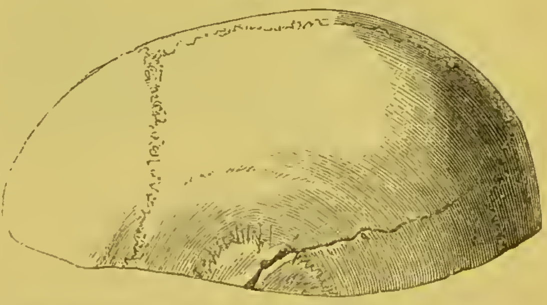
ARRANGEMENT OF FRACTURES OF THE CRANIUM.

These fractures present every possible variety of form, from the most simple fissure to the most complicated fracture extending in many directions, and accompanied with depression. The ancient writers divided fractures of the cranium into many different varieties, distinguishing each by an appellation descriptive of its form, or of some peculiarity in the relation of the fractured parts; but these appellations, as they burdened the memory without leading to any useful practical results, are now abandoned. To show clearly the views now entertained respecting the nature and treatment of these injuries, it will be convenient to arrange them in the following six classes. First, Simple fissure, or fracture unattended with depression. Second, Simple fracture with depression. Third, Punctured fracture. Fourth, Compound or open fracture. Fifth, Fracture of the external table alone; and Sixth, Fracture of the internal table alone.

I. SIMPLE FISSURE, OR FRACTURE UNATTENDED WITH DEPRESSION.

As in this injury there is no wound in the soft parts, and the broken pieces preserve their proper level or equality of surface, and as the simple interruption to continuity of the bone produces no symptom denoting its presence, it often escapes detection, and continues during life a matter of uncertainty. Simple fracture, considered in itself, is by no means a dangerous injury, and when its existence is suspected, and there is no accompanying injury of the parts within the cranium, it is not necessary to do more than enjoin every prudent precaution against the occurrence of inflammation. The violence which breaks the bone may give rise to separation of the dura mater, laceration of the brain, extravasation of blood within or upon the brain, or above or below the dura mater, or to simple fissure of the outer table and fracture with depression of the inner; and in consequence of some of these accompanying conditions within the head, there may be concussion immediately after the injury, or the symptoms of compression or of inflammation of the brain or its membranes may appear, with all their usual consequences, to a dangerous or even fatal extent. The treatment of these conditions will be afterwards described.

Fig. 81.

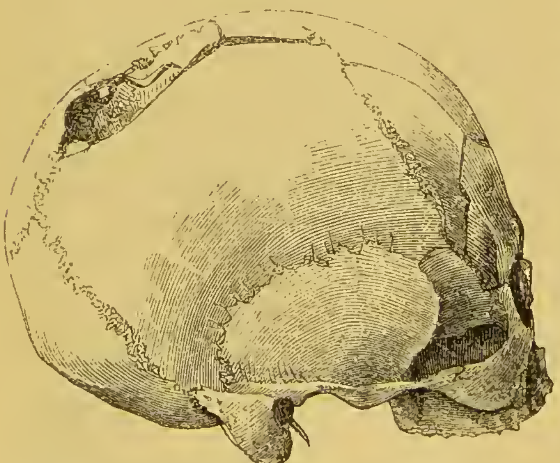


Simple fissure of cranium, produced by a fall on the side of the head. The case occurred in the experience of my colleague, Dr. Dyce. From a preparation in my museum.

II. SIMPLE FRACTURE WITH DEPRESSION.

The local signs of this injury are,—an inequality of the surface of the cranium, varying in extent according to the amount of depression, and usually the appearance of a bruise of the scalp. Sometimes the fragments are movable; in other instances the depressed portion is quite unyielding. There is a condition of scalp, frequently presenting itself after a contusion, more especially if inflicted by a flat body, which is very deceptive, and apt to make the inexperienced observer suppose that the depression of bone is to a much greater extent than it really is, and even to produce the impression that the bone is driven in, when no fracture really exists. I refer to the swelling caused by extravasation. Into the cellular tissue surrounding the contusion blood becomes extravasated, and this raises the soft parts to a considerable extent; whereas, at the bruise itself, if the contusion has been severe, the soft parts remain compressed in consequence of the cellular tissue having been deadened and the vessels paralysed by the bruise. The swelling is remarkably firm, and the impression given to the finger by the extravasated blood so closely resembles that given by the margin of a fractured portion of bone, that it is very likely to deceive an unguarded observer. This condition of the soft parts should be always kept in mind, lest the surgeon be deceived, either into the supposition that there is depression where none exists, or into the opinion, when it is present, that it is to a greater extent than is really the case. If the injury be not inflicted by a flat body, the whole of the scalp may be elevated at the injured part. Extravasation may be found in three different situations, namely, between the integument and the tendon of the occipito-frontalis muscle, between the occipito-frontalis muscle and the pericranium, or between the latter and the bone. Besides the local appearances here described, fracture with depression may be attended with the usual symptoms of compression of the brain; for an account of which I must refer the reader to the chapter on Compression.

Fig. 82.



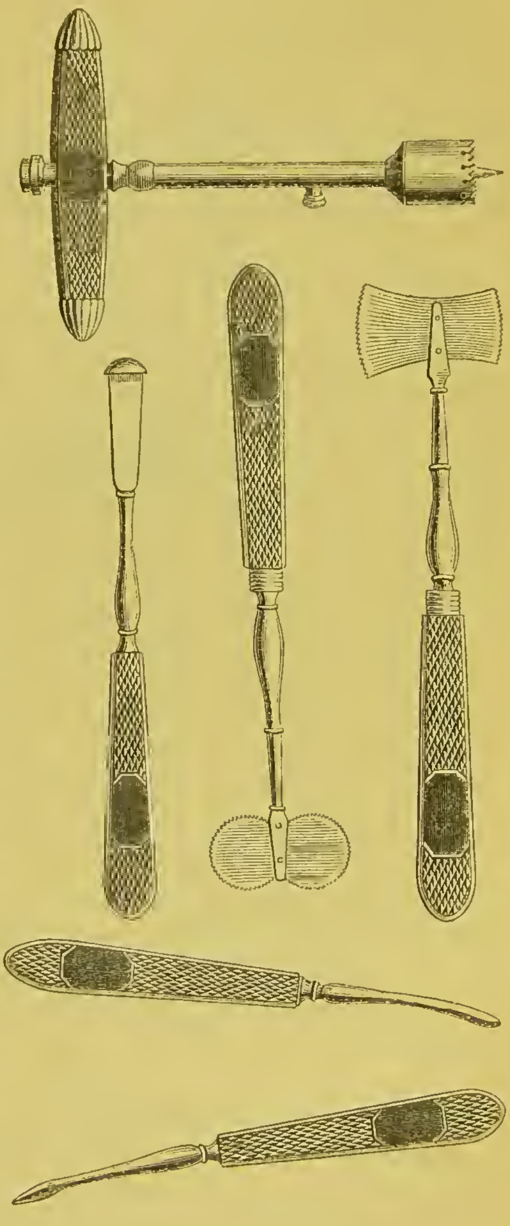
Fracture of cranium with depression. From a preparation in my museum.

In regard to these symptoms, the intelligent surgeon will not only keep in mind the different conditions on which they depend, but in order to arrive at a correct diagnosis, and to ascertain from which of the various different conditions the symptoms in any particular case may proceed, he will inquire very minutely into the history of their appearance. Compression of the brain, proceeding from external injury, may be occasioned by a depressed portion of bone, or extravasation of blood, or the formation of purulent matter. The time when the symptoms made their appearance will be found the surest guide in determining to which of these three causes they are to be attributed. When a depressed portion of bone occasions the compression, the symptoms present themselves on the occurrence of the injury; when extravasation of blood is the cause, the symptoms do not appear immediately, except sometimes in a very slight degree; and it is not until a considerable quantity of blood has collected, that they show themselves very decidedly. When a patient, having been stunned by an injury of the head, recovers from the stun, and symptoms of compression afterwards appear and gradually increase, there is then reasonable ground for supposing that they arise from effusion of blood. When the compression is caused by the formation of matter, it does not appear for several days, and is preceded by the symptoms of inflammation of the brain, or its membranes. Thus the history of the symptoms is a useful guide in determining the cause on which the compression depends. It is important to remember, that the injury of the one table scarcely ever corresponds with that of the other, the inner being almost always fractured to a greater extent than the outer, and the actual depression of the inner table being much greater than would appear from the examination of the outer part of the cranium. It is a remarkable fact, but one of which the records of surgery furnish many examples, that there is no certain correspondence between the symptoms of compression and the extent to which a portion of the bone may be depressed. In some instances, where the depression has not been to a great extent, the symptoms have been decidedly marked; in others, the symptoms have been very slight, when the depression has been manifest and considerable. Hence the statement of an eminent modern writer, "It is extraordinary and unaccountable, but it is not less true, that no calculation of the bad effects can be made, by the degree to which a part of the skull is depressed."

Treatment.—The object to be aimed at by treatment varies according to the presence or absence of the symptoms of compression. In the absence of these symptoms, the indication of treatment is to prevent the occurrence of inflammation, and for that purpose the strict antiphlogistic regimen, consisting of low diet, rest, and quietude, should be enjoined. It is also advisable to shave the head, to keep it cool by means of cold applications, to administer some smart purgative, and in some habits of body, it is prudent, even as a precautionary measure, to have recourse to depletion, provided there be much reason to apprehend inflammatory action. It would, however, be extremely injudicious to have recourse to depressing treatment in the period of collapse which immediately succeeds such an injury; and after this period is passed by, the extent to which this treatment ought to be carried should be regulated by the age, habits, and constitution of the patient, and the particular circumstances of the case.

If symptoms of depression be present, then the immediate object to be aimed at, is to relieve the brain from pressure; and the means to be taken, in the first instance, for that purpose, will depend on the extent of the depression, and the urgency of the symptoms. If the bone be not depressed to a very great extent, and if the symptoms be not extremely urgent, the attempt should first be made to relieve the pressure of the brain by bleeding, purging, and the constant application of cold to the head after it has been shaved. Under this alleviating treatment, the brain sometimes becomes accommodated to its new condition, and the symptoms disappear. If after the proper measures have been employed for a moderate period, the symptoms still continue, then the depressed portion of bone must be elevated. But if the depression be not only manifest, but also to a great extent, and the symptoms of compression be very strongly marked, then the surgeon is justified in elevating the depressed portion of bone without waiting to ascertain the effect of the alleviating treatment recommended above. It appears, then, that in this variety of fracture, the circumstances under which the surgeon is warranted in proceeding to operate are,—either when the symptoms continue unabated after the judicious employment of bleeding, purging, and the constant application of cold to the head; or, without waiting for the employment of these remedies, when the symptoms are alarmingly urgent, and the bone depressed to such an extent as to leave no hope of the brain becoming accommodated to its unnatural condition. When, in either of these cases, the surgeon has resolved to elevate the depressed portion of bone, he should first expose the fracture by making a crucial incision, and then raise the bone by means of some of the different forms of elevators used for that purpose. If, as is often the case, it should be impossible to introduce the elevator underneath the depressed portion, the surgeon is justified in trephining, his object being, not to saw out the depressed portion, but to remove a part of the bone which is not depressed, so as to admit of the introduction of the elevator, by which the depressed part may be raised to a level with the surrounding parts of the cranium.

I cannot conclude this chapter without referring to a most extraordinary case, which shows, that at a very distant period from the accident, the symptoms of compression may be removed and the patient restored to his ordinary powers of body and mind. The case seems to have produced a deep impression on the mind of Sir Astley Cooper, who records it in the following words :—"The other circumstance which I shall mention, is one, which, whether we regard it in a physiological or surgical point of view, is perhaps one of the most extraordinary that ever occurred; and, as connected with surgery and physiology, I am surprised it has not made a greater impression on the public mind than it appears to have done. A man was pressed on board one of his majesty's ships, early in the late revolutionary war. While on board this vessel in the Mediterranean, he received a fall from the yard-arm, and when he was picked up he was found to be insensible. The vessel soon after making Gibraltar, he was deposited in an hospital in that place, where he remained for some months still insensible, and some time after he was brought from Gibraltar on board the 'Dolphin' frigate to a depôt for sailors at Deptford. While he was at Deptford, the surgeon under whose care he was, was visited by Mr. Davy, who was then an apprentice at this hospital. The surgeon said to Mr. Davy, 'I have a case which I think you would like to see. It is a man who has been insensible for many months; he lies on his back with very few signs of life; he breathes, indeed, has a pulse, and some motion in his fingers; but in all other respects he is apparently deprived of all powers of mind, volition, or sensation.' Mr. Davy went to see the case, and on examining the patient, found that there was a slight depression on one part of the head. Being informed of the accident which caused this depression, he recommended the man to be sent to St. Thomas's Hospital. He

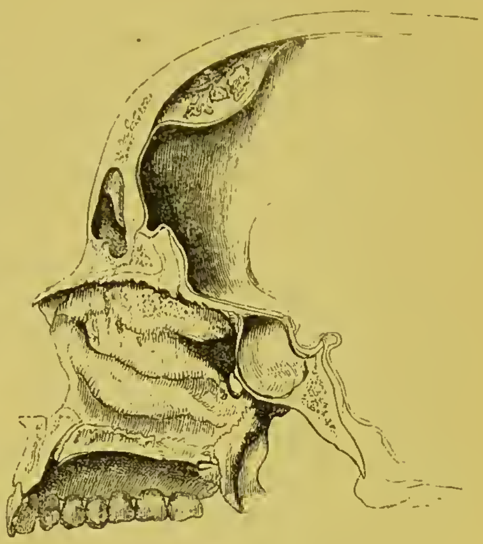

Figs. 83 to 88.

was placed under Mr. Cline, and when he was first admitted into this hospital, I saw him lying on his back, breathing without any great difficulty, his pulse regular, his arms extended, and his fingers moving to and fro to the motion of his heart, so that you could count his pulse by this motion of his fingers. If he wanted food he had the power of moving his lips and tongue; and this action of his mouth was the signal to his attendant for supplying his wants. Mr. Cline, on examining his head, found an obvious depression; and thirteen months and a few days after the accident he was carried into the operating theatre and there trephined. The depressed portion of bone was elevated from the skull. While he was lying on the table, the motion of his fingers went on during the operation; but no sooner was the portion of bone raised than it ceased. The operation was performed at one o'clock in the afternoon. And at four o'clock, as I was walking through the wards, I went up to the man's bed-side, and was surprised to see him sitting up in his bed. He had raised himself on his pillow; I asked him if he felt any pain, and he immediately put his hand to his head. This showed that volition and sensation were returning. In four days from that time the man was able to get out of bed, and began to converse; and in a few days more he was able to tell us where he came from. He recollected the circumstance of his having been pressed, and carried down to Plymouth or Falmouth; but from that moment up to the time when the operation was performed (that is, for a period of thirteen months and some days) his mind remained in a state of perfect oblivion; he had drunk, as it were, the cup of Lethe; he had suffered a complete death, as far as regarded his mental, and almost all his bodily powers, but by removing a small portion of the bone with the saw, he was at once restored to all the functions of his mind, and almost all the powers of his body. It appears, therefore, that in cases of depression we should not be prevented from trephining, however distant the period may be at which the accident occurred, and the patient may, after any interval, be restored to the powers of body and mind."

III. PUNCTURED FRACTURE.

When a fracture is caused by a sharp body, such as a corner of a stone, or by any pointed instrument, such as a bayonet or a pitchfork, or by a sharp-pointed body of any kind, which applies force with concentrated effect, it usually presents the appearance of a cavity, or mere puncture, and is hence called a punctured fracture; and because there are often numerous fissures radiating on every side from the centre, it is also called star-like or radiated fracture. From the manner in which such a fracture is occasioned, it is often attended with a wound of the soft parts. The internal table is, on account of its brittleness, injured to a greater extent than the external, and there is one circumstance in this form of fracture which renders it so exceedingly dangerous as to require immediate recourse to an operation, even in the absence of compression, or of every bad symptom. This circumstance is, that spicular portions of the internal table are always driven inwards, and if these be not removed, it is almost certain that inflammation will be excited, and if so, the ordinary remedies will have no effect, while the exciting cause continues; and if the operation be delayed until inflammation has taken place, it will then be too late to save the patient. In short, the very existence of this form of fracture imperatively calls for an operation. On exposing the fracture the depressed portions should be raised; and if it be impossible to introduce the elevator or forceps, it will be necessary to remove a small part of the sound portion of the cranium for the admission of the instrument. After the cause of irritation has been removed, and the edges of the wound been approximated, the treatment will consist of the rigid institution of antiphlogistic regimen to prevent inflammation, and to subdue it in case of its occurrence.

Fig. 89.



From Liston.

IV. COMPOUND OR OPEN FRACTURE WITH DEPRESSION.

On this important subject, Sir Astley Cooper remarks, "Compound fracture is followed very generally by inflammation of the brain, and it will be of no use to trephine, when inflammation is once formed. It might be thought that it would be time enough to perform this operation when inflammation had appeared; but this is not the case; for if inflammation comes on, the patient will die, whether you trephine or not; and you will be so far from arresting its final progress by trephining, that the operation will add to the danger of the inflammation. When inflammation of the dura mater and membranes has been excited by depression of the bone, you cannot retard the progress of death by performing the operation."

Sir Astley Cooper enforces these principles by cases, and concludes by saying, "The elevation of the bone is never followed by any mischief; but if you do not raise it, and inflammation follows, it will be too late to attempt to save the life of the patient." In reference to this doctrine laid down by Sir Astley Cooper, Sir Benjamin Brodie, after referring to the fact that many persons undoubtedly have recovered, in whom there was at the same time a wound in the scalp and a fracture with depression of the cranium, although no operation was performed, and after referring to examples published by Mr. Abernethy, and various cases which occurred at the battle of Talavera de la Reyna, and were communicated by Mr. Rose, Surgeon to the Coldstream Regiment of Guards, goes on to say, "I have conversed also with other surgeons, whose experience has compelled me to doubt the accuracy of Sir Astley Cooper's conclusion. The question, however, is not to be decided merely on these premises. Many persons may do well without an operation, who suffer from what Sir Astley Cooper denominates a compound fracture of the cranium, and yet it may remain to be determined what is the probability of suppuration taking place in these cases as compared with those in which the scalp remains uninjured. For many years I have preserved notes of a large proportion of the cases of injury of the head, which it has fallen to my lot to witness. Among them, of course, are many in which there was fracture with or without depression, followed by suppuration between the dura mater and the bone. On referring to these for further evidence on this interesting subject, I find that the cases in which suppuration takes place where the scalp is entire, have been comparatively rare; bearing a very small proportion indeed to those cases in which suppuration has followed a fracture complicated with a wound of the scalp. Such is the result of my own experience during a considerable period of time, and which I am enabled to give, not merely from a general recollection of what I have seen, but on the authority of written notes, made at the bedside of the patients, and, for the most part, before the question which they illustrate had ever presented itself to my mind. Taking all these facts into consideration, and endeavouring to give its proper value to what may be urged on either side of the question, I cannot but acknowledge, whatever may have been my first impression on the subject, that it appears to me at this moment that the views of Sir Astley Cooper are well founded, and that in those cases in which a depression of bone exists, without any symptoms, or with only very trifling symptoms, arising from it, the surgeon can follow no better general rule than this; if the depression be exposed in consequence of a wound of the scalp, let him apply the trephine, and elevate the depression; but if there is a depression without a wound of the scalp in consequence of the accident, let him not make such a wound by an operation."

From the above, it will be evident that the views of Sir Astley Cooper, as to the necessity of trephining in compound fracture with depression, in the absence of any symptoms of pressure, received, after much deliberation, the decided approval of Sir Benjamin Brodie. A different opinion, however, is maintained by many surgeons; and Professor Samuel Cooper, as will appear from the following extract from his lectures, seems inclined to agree with those who do not recommend an operation, except when symptoms of compression are present. In speaking of the doctrine laid down by Sir Astley Cooper, he says, " I cannot say that the observations which I have had opportunities of making on this point of surgery, would have led me to adopt this opinion." Sir Philip Crampton remarks on this subject, " In Dublin we conform in general to the rule of practice originally laid down by Dease, who preceded Desault by many years, namely, in fractures of the skull with depressed bone, *whether complicated by wound of the scalp or otherwise*, no attempt should be made to raise the depressed bone, *unless very decided symptoms be present of compressed or irritated brain.*"

Sir P. Crampton mentions that he has seen many cases terminate very favourably without the trephine, and refers to some in the very interesting paper in which he states the above views. On this point it will be evident that Sir P. Crampton and Professor Samuel Cooper are agreed, and that their opinion is opposed to that of Sir Astley Cooper and Sir Benjamin Brodie. Some surgeons are of opinion, that in the absence of compression, trephining is justifiable only when the compound fracture partakes of the nature of punctured fracture ; and others, that the surgeon should be guided by the extent of the depression, the condition of the fragments, and the possibility of elevating them without increasing the wound of the scalp. For my own part, as Sir Astley Cooper's opinion is given with so much decision, and is founded on so extensive an experience, I should hesitate very much to advise any different procedure.

V. FRACTURE WITH DEPRESSION OF THE EXTERNAL TABLE.

Fracture of the external table, with depression into the diploë, cannot take place either in early life or frequently in old age, as the skull is, at both these periods, comparatively thin and without diploë; but that it has taken place in the middle period of life is no longer a matter of uncertainty. This condition of the external table, the internal remaining at the same time perfectly entire, has now been demonstrated by many specimens, in which the occurrence of reunion proves that the patients must have lived for some time after the injury. The possibility of this condition suggests the propriety of caution in forming a diagnosis, and furnishes a reason why mere depression of a part of the cranium does not, if unaccompanied with compression, warrant the performance of trephining.

If unattended with concussion, this injury is not likely to lead to any serious consequences, nor does it require any treatment beyond the precautions proper to be attended to, after every kind of injury in the region of the head.

VI. FRACTURE WITH DEPRESSION OF THE INTERNAL TABLE.

The records of surgery furnish various examples of this fracture, every one of which, attended with unfavourable symptoms, must form a case of great anxiety and difficulty to the surgeon. Professor Samuel Cooper records a case of this kind, with urgent symptoms, in which he performed the operation of trephining at Brussels, after the battle of Waterloo. The external table was perfectly entire, but a large splinter of the inner was driven more than an inch into the brain, and on its removal, the patient's senses and power of voluntary motion returned. The part of the skull to which the trephine was applied, did not, of course present any depression, and it was selected because the appearance of the scalp showed that there the external violence had been inflicted. In Dr. Hennen's "Military Surgery," a case is recorded, in which the external table was entire, and the internal splintered and driven more than half an inch into the brain. I have seen two fatal cases of fracture of the internal table, in which the external was perfectly entire.

If a patient has been struck, or has fallen upon a certain part of his head, and if the external table be entire, and the symptoms of compression supervene, the difficulty of diagnosis is sometimes very great, for the history of the symptoms is almost the only guide to the surgeon in forming a conjecture, as to whether the symptoms be caused by depression of the internal table, by extravasation of blood, or by matter; and yet it is sometimes impossible, from the history, to arrive at a decided opinion, because although it is true, that in depression, the symptoms which indicate the state of the brain come on immediately after the injury, and in extravasation, some time elapses before they appear, and they become more distinctly marked as the blood is effused from the ruptured vessels; still, in a case of extravasation, the patient may have been insensible, in the first instance, from being stunned, or from the concussion of the brain, and before the insensibility from this cause has worn off, insensibility from compression may have come on; in such a case, the patient having been insensible from the very occurrence of the injury, it would be impossible to determine whether the compression has been caused by extravasation, or by fracture with depression; and accordingly, we find that in some successful cases, in which trephining was performed, in the expectation of finding the cause of pressure to be blood extravasated under the cranium, it turned out to be fracture with depression of the inner table. But supposing the injury of the internal table has given rise to extravasation of blood, or the formation of matter, although the surgeon should think that there is little doubt which of these is the cause of the symptoms in any particular case, still he has no certain guide as to the precise seat of the collected matter; he has no decided and unequivocal symptom to enable him to determine, whether the blood be above or below the membranes of the brain, and consequently, the real nature of the case, and the exact condition of the patient, must be very uncertain, and the indications of treatment extremely doubtful and precarious. It would be saying too much to affirm, that in every instance, the surgeon should confine himself to the use of the alleviating remedies for pressure, formerly enumerated, and that what has very appropriately been called "exploratory trephining" should never be performed in any case. That in which the indication of treatment would be most clear, and the operation, if ever advisable, most warranted, is, where symptoms of compression come on after an injury, in the situation of the middle meningeal artery. On this subject Sir Benjamin Brodie remarks:—"Where no fracture is discovered, yet if there is other evidence of the injury having fallen on that part of the cranium in which the middle meningeal artery is situated, the use of the trephine may be resorted to on speculation, rather than that the patient should be left to die without an attempt being made for his preservation. I cannot indeed adduce any particular experience of my own in favour of what is here recommended; but I conceive that the instances which have been recorded, in which the middle meningeal artery has been ruptured without any fracture of the bone, and the known fact that there is sometimes a fracture of the inner table, sufficiently justify such an experiment in desperate cases, or even in those in which there is much danger."

On this very important and interesting subject of fractures of the cranium, I must limit myself to the above observations; but at the conclusion of the chapter on Compression of the Brain, will be found an enumeration of the conditions in which, according to the views now entertained regarding the treatment of injuries of the head, the operation of trephining is considered advisable.

CHAPTER IX.

INJURIES OF THE BRAIN.

CONCUSSION OF THE BRAIN.

Causes.—The injury which is termed by British authors "Concussion of the Brain," by French, "Commotion," and in common parlance "stunning," is produced by one or other of the three following causes:—A blow, or a fall, on the cranium itself, or a fall from a considerable height on some other part of the body, as the buttocks, or the feet, by which a sudden shock is communicated to the brain, through the medium of the vertebral column. I lately had under my care a mason, in whose case there were strongly marked symptoms of concussion, caused by his falling from the second floor of a house on his buttocks; and I am at present attending a female, who, in consequence of the horse becoming restive, jumped from the top of a cart loaded with hay, and alighting on her feet, sustained fracture of one leg, and concussion of the brain. The spine in these circumstances is suddenly brought into a state of rest, and the head being still in projectile motion, is forcibly struck against the summit of the vertebral column: the sudden jerk thus communicated to the brain occasions "concussion."

Symptoms.—For facilitating the description of the symptoms of concussion, it will be convenient to adopt Mr. Abernethy's arrangement of them into three stages; an arrangement not only advantageous for promoting a clear understanding of the symptoms, and for reconciling by accurate discrimination some of the various descriptions of them given by previous writers, but valuable also, together with his other observations, as having led to more correct and scientific views of practice than formerly prevailed. By referring to his Surgical Observations on Injuries of the Head, it will be found, that he arranged the symptoms into three stages, which he called the first, second, and third. The first stage, which immediately follows the injury, is one of collapse, in which there is insensibility, with derangement of bodily powers; the second is one of reaction, in which there is, to a greater or less extent, some return of sensibility, and restoration of bodily powers; and the third is one of inflammation of the brain, indicated at first by increased excitement of that organ, and increased vascular action; and this stage is certainly not the least important of the series of consequences which result from concussion.

In well-marked examples the different stages are characterized by the following symptoms:—

In the first stage, the operations of mind are in many instances suspended, and often to such an extent, that consciousness is entirely lost for the time; the functions of the brain, and of the organs of sense are also suspended, so that there is complete insensibility to all external impressions. Common sensation and voluntary motion are also lost for the time; and often the loss of sensation is so great, that the patient gives no indication of being pained, on pinching or irritating the skin; in short, he does not feel any injury inflicted on him; and with regard to motion, it does not seem to be the power of contractility that is lost, so much as the power of voluntarily combining the action of the muscles, so as to perform any particular movement. The operations of mind, and the powers of sensation and of voluntary motion, are usually suspended together; but I have seen instances in which the loss of the one is greater than that of the other. Sir Astley Cooper records a well-marked example in a gentleman, who at one time, in the absence of his attendant, got out of bed, bolted the door, passed water, and went to bed again; yet he was so insensible, that every attempt to get a word from him was ineffectual; and Sir Astley Cooper says, he does not believe that the noise of an earthquake would have succeeded in rousing him from his lethargy. The countenance is pale and collapsed; the surface, especially at the extremities, cold; the respiration is, by some observers, said to be easily and naturally performed; in slight cases, certainly, it is almost natural, but in such as are well marked, it is very feeble and without stertor. The pulse is weak, slow, fluttering, and often intermittent, and in the extremities scarcely perceptible. The pupils contract on the application of light, showing that the retina is not perfectly insensible; and as regards the size of the pupil, in the cases of which I have kept notes, it was usually contracted when the concussion was slight, and dilated when it was very severe. Some authors have occasionally found one pupil contracted, and the other dilated; and in the first instance not dilating in darkness, nor contracting farther when the light was suddenly increased. Vomiting is an early symptom, and is referred to that well-known sympathy between the brain and stomach, of which so many examples could be given; a sympathy maintained through the pneumogastric nerves. If the concussion be severe, and the symptoms continue long, there may be the same condition of the urinary organs as in compression, the rationale of which condition will be explained in the chapter on Compression.

The above symptoms may be changed into those of the second stage, or into those of compression, or they may terminate fatally without passing through any further change.

In the second stage, the operations of mind are not so completely suspended as in the first, and the insensibility is diminished, although still so great, that ordinary impressions produce little effect, and the powers of attention and perception are still in a great measure lost; the functions of sensation and volition are also in a considerable degree restored. In consequence of this alleviation, although the patient lies as in a kind of sleep, it is possible to rouse him for an instant. By putting a question to him in a loud, sharp tone of voice, an answer is obtained in a monosyllable, and as if his attention were taken up about something else; he then instantly relapses into his former state. Such questions seem to be more readily answered, if they refer to the patient's state. The pupil is usually contracted, and the sensibility of the retina is evinced by the patient drawing his head from the light, when the eyelids are opened. The functions of the organs of sense, though much less acute than naturally, are not entirely suspended; and sensation and power of motion are in a great measure restored, as will be shown by his withdrawing his limbs when they are pinched. Although the patient lies in a comparatively insensible state, and generally in the position in which his body happens to be placed, yet there are occasional fits of restlessness, and in this respect, concussion differs from compression, inasmuch as in the latter state, there is uniform and permanent insensibility, with total loss of the power of motion. The circulation and respiration are more vigorous in the second stage than in the first; and in consequence, a natural warmth is diffused over the body. The pulse is firmer, fuller, and stronger; and if the patient be so far recovered as to be able to raise himself up, or to make any exertion, a condition of pulse will be perceptible, which is quite characteristic of concussion;—I refer to its very great acceleration when the patient rises up, or makes exertion of any kind. Sometimes when the pulse is not more than from seventy to eighty in the recumbent posture, it is so greatly accelerated by the patient's rising, as to reach from one hundred and twenty to one hundred and thirty in a minute. There is also, in general, an unusually strong beating of the carotid vessels, especially on making exertion; and when the patient is able to describe his feelings, he generally complains of headache. I lately had under my care a lady with concussion of the brain, in whose case great throbbing of the carotid vessels, and great acceleration of the pulse, continued for a very considerable time after all other traces of the injury had disappeared.

The above symptoms may gradually subside, or they may pass into those of compression, or into those of the third stage.

The third stage is one of pure inflammation of the brain, and is indicated by great pain in the head, increased heat and throbbing of the vessels about the head, full and flushed countenance, intolerance of light and sound, of light sometimes even through the eyelids, suffusion of the eyes, watchfulness, restlessness, and delirium, together with great quickness of pulse, heat and dryness of skin, diminution of secretion, and, in short, all the usual symptoms of irritative fever.

These symptoms may yield to remedies, or they may pass into the symptoms of compression, and prove fatal in the way of coma.

Such are the symptoms of concussion in well-marked examples, when the disease runs its course; but, as in other injuries, the symptoms vary according to the violence of the concussion, so that between slight, transient stunning, which wears off in a few minutes, and the state described above, there are many intervening shades. Sometimes the patient appears merely to have received a slight stun, and in a few minutes he is quite well; at other times, the symptoms are more marked, and of longer duration, yet they wear off without being succeeded by any signs of the inflammatory stage; while there are instances, in which the disease runs its course, and the patient falls a victim to it, death taking place in the way of coma. Sometimes concussion and compression exist together, and the phenomena of these two states are so intermingled, that the surgeon is occasionally at a loss to determine on which condition chiefly the symptoms depend.

CONSEQUENCES OF CONCUSSION SOMETIMES OBSERVED.

Some patients recover from even very severe forms of concussion, without having in after life any trace whatever of the injury; but others are found to suffer various affections resulting from it, for a considerable time after their recovery, or even through their whole life. These consequences may affect either the mind or the body. The power of continuous attention is often lost, or very much diminished; slight weakness of intellect, and even complete mental imbecility have sometimes been occasioned; but of all the mental powers, the memory is most frequently affected, the injury being attended with this peculiarity, that all recent events and impressions are forgotten, while those of an earlier period are remembered. For example, it has been found that a patient, who, before concussion, conversed in a language recently acquired, had on his recovery entirely forgotten it, but was still able to speak a language which he had acquired long before. In some cases, the recollection has been lost of almost all impressions of a late date, while those of early life are distinctly remembered. This affection of the memory has been compared to that which takes place in old age, and it has been said, that in this respect, patients appear, as far as memory is concerned, as if they had suddenly grown old. In some instances, the affection of the memory has a different character, and the patient is unable to remember the proper word to be used for naming an object, or for describing its quality. Desault mentions a curious case of a man, who, after concussion, could remember only recent events, but afterwards lost the recollection of everything recent, and could only remember what had occurred in his early life. It is sometimes found that some of the organs of the external senses are permanently affected; thus, the use of one ear, or of one eye, may be altogether lost, or the sight considerably impaired. In some instances, the sight is affected in a peculiar way, so that only part of an object can be seen at one time, and the patient must move his head in order to obtain a view of the whole object. To such an extent has this been observed in some cases, that the patient has been unable to see all the letters of a word at the same time. Severe vertigo, or pain in the head, on making any exertion, and great muscular weakness are very frequently consequences of concussion.

DIFFERENT WAYS IN WHICH CONCUSSION PROVES FATAL.

It would be quite foreign to the object of this work, to give any detailed account of the experiments made by physiologists, to ascertain the effect produced on the organs of circulation by injuries on the brain and spinal cord; but the following results of experiments on the nervous centres, and the conclusion drawn from them, as bearing on the interesting subject under consideration, may be given. 1st. Legallois, and Dr. Wilson Philip, in their experiments, carefully removed the whole of the brain and spinal cord, and *when artificial respiration was kept up*, the action of the heart did not cease for some hours; from which experiments the conclusion is drawn, that the action of the heart is independent of the brain and spinal cord. 2nd. In the experiments of the same physiologists, it was found that when any sudden or extensive injury, as a violent concussion, was produced on part of the brain or spinal cord, an immediate and great depression, or complete suspension of the action of the heart was the result; from which it is concluded, that a sudden injury of the nervous centres, such as a violent and sudden concussion, suspends the action of the heart, and thus proves fatal; that, in short, death occurs by syncope, or begins at the heart. The vital power of the heart seems to be destroyed; for, when the chest is opened immediately after death, it is impossible to excite contraction, and in that respect, as will afterwards be shown, the condition of the organ is not the same as in death by coma, where the immediate cause of death, as will be seen in the chapter on Compression, is asphyxia, or suspended action of the lungs.

The difference between the effects of a blow or concussion, and a wound of the brain, is very remarkable. Mayo observed on this subject:—"A great part of the brain of an animal may be gently and quietly sliced away with little or no effect; but if ever so small a portion be suddenly crushed, the heart stops directly." This difference is also very strikingly mentioned by Cole in his "Field-Practice in India."—"The English dragoon sword is so blunt, that the strongest man cannot drive it through the head-dress of the Sikh or Afghan; nevertheless, the enemy is most often beaten from his horse, and frequently killed by the violence of the shock. Not so, however, with the trenchant blade of the Sikh; this weapon, wielded by a strong man, will cut through any head-piece, and bury itself perhaps in the brain, and yet you find no symptoms of concussion or compression. In the former example, the soldier is effectually disabled, often killed outright; in the latter, although the individual is mortally wounded, he may be able to continue the fight, and even to kill his antagonist before he falls himself dead or dying from his horse."

3rd. From the experiments of Chossart and others, there appears to be some variety as to the part of the circulation chiefly affected by certain injuries of the nervous centres. Chossart found in some of his experiments, that in certain injuries of the brain and spinal cord, the circulation in the capillaries appeared to be for some time more affected than the action of the heart; but still, it is by failure of the circulation that such injuries ultimately prove fatal. It is only by a knowledge of the dangers which threaten in different stages, that we can be guided to rational and scientific principles of treatment.

When concussion proves fatal in the first stage, it is by failure of the action of the heart. Sometimes this failure is instantaneous; sometimes it goes on gradually increasing to a fatal termination; and sometimes there is a very partial reaction, and then a second failure of the organs of circulation, which proves fatal. It is evident, therefore, that the state of the circulation must, in this stage, be watched with much anxiety by the skilful practitioner.

When concussion has proved fatal by failure of the heart's action, the heart is in some cases, particularly in those which have been very suddenly fatal, found to be quite empty, a circumstance the cause of which, as Dr. Alison remarks, is not easily explained. In other cases, it is distended; but the distinguishing peculiarity is, that there is no difference in the quantity of blood in its right and left sides: in this respect, also, the state of the heart is different in death by asphyxia, as will be shown in the chapter on Compression.

Another way in which concussion proves fatal, is by compression of the brain. This may take place soon after the injury, when blood from the vessels of the lacerated portion of brain has had time to accumulate in some quantity; or after reaction has taken place from extravasated blood; or in the third stage from serous effusion, or the formation of purulent matter, as results of inflammation.

APPEARANCES AFTER DEATH.

The appearances within the head vary according to the length of time between the injury and the fatal event. Separation of the dura mater from the inner surface of the cranium, when the blow on the head was severe, is a very common condition. In cases which almost instantly, or very speedily prove fatal, laceration of a portion of the brain is often observed : but it has long been ascertained by the investigations of surgeons, that concussion often proves fatal, and that very suddenly, without any perceptible unnatural condition either of the cerebral substance, or of the vessels within the head ; in short, without any discernible injury of the brain, its vessels, or its membranes. In cases rather more advanced, small specks of blood in some parts, or laceration of the brain, are met with; and in cases still further advanced, besides some of the above appearances, various traces of inflammation are observed, such as a turgid condition of the vessels, increased vascularity in the membranes or brain, or various kinds of inflammatory effusion, as serous, gelatinous, or purulent, or sometimes of lymph, or different combinations of some of the above results of inflammation. Surgeons have been anxious to determine in what way concussion suspends, to a fatal extent, the function of the brain in those instances in which no derangement of its organization is discernible on dissection. Some suppose it may be by the sudden shock disturbing the circulation of the brain ; but others think it more probable that the structure may be injured, although the injury may not be discovered by dissection. Sir Benjamin Brodie seems to be of the latter opinion ; he remarks,—" If the structure of the brain is on so minute a scale that our senses are incapable of detecting it, it is evident that there may be changes and alterations of structure which our senses are incapable of detecting." Some surgeons, again, seem to think that the fatal suspension of function may be caused by condensation of the brain. Mr. Liston says,—" When a blow is inflicted on the skull, only a slight commotion of the brain is induced, the cranial contents are, as it were, slightly jumbled, and a temporary and trifling disturbance of its functions follows. When, however, the stroke is more severe, the brain is separated from its cranial attachments, both at the point struck, and at the part directly opposite ; it is thrown upon itself towards its centre ; its substance is thereby condensed, its diameter in the direction of the impulse diminished, and a separation between the brain and cranium is formed at each extremity of that diameter. By *post-mortem* examinations it has been ascertained, that condensation of the substance of the brain does exist in cases of severe concussion. Such condensation may be sufficient to cause instant extinction of life, or the brain may gradually resume its former condition, or with only such slight incited action as may be required to reunite the dura mater with the inner table of the skull." Such are the opinions which have obtained on this subject, but it appears very evident, that our knowledge of it is still very imperfect.

Treatment.—There are few points on which greater diversity of opinion has prevailed than on the treatment of concussion ; indeed, two directly opposite methods have each had their advocates. Some surgeons, from a supposed analogy between insensibility in fainting, and insensibility in concussion, have advised stimulants and cordials; while others inculcate the necessity of bleeding and other antiphlogistic remedies. Pott in England, and Boyer in France, insisted on the necessity of bleeding; the latter to an extent unknown in this country. From the arrangement of the phenomena of concussion into three stages, from the condition on which the symptoms depend, and from what has been ascertained regarding the different ways in which it proves fatal, and the dangers of each stage, rational and scientific principles of treatment have been deduced. The treatment proper for each stage is a subject of great practical importance.

In the first stage, when the symptoms of depression of the powers of life are so urgent that there is danger of death from failure of the circulation, it would certainly be extremely injudicious still further to depress the system by bleeding; for this would be almost to take away the patient's chance of life: but, on the other hand, it would be hazardous to administer wine, stimulants, or cordials, as the occurrence of phrenitis, the condition on which the third stage depends, would be rendered more certain, and its severity, if it should occur, be in all probability increased. Such means should therefore be employed to restore the circulation as are not calculated to have a permanently stimulating effect. With this view the patient should be laid in bed, covered with warm blankets, and have heat applied to the surface of the body, more especially to the extremities and abdomen. When the circulation is restored, the heat should be withdrawn. When the power of swallowing is regained, if the above means should not have produced the desired effect, and the patient be evidently in a very dangerous state, the surgeon may venture upon the use of some of the diffusible stimulants, such as ammonia, provided the power of swallowing be sufficiently restored to remove all risk of the fluid entering the larynx. Since ammonia and other diffusible stimulants have not any permanent effect on the circulation, there is not the same objection to their use as to that of brandy, wine, or any such powerful stimulants. The state of depression is in general but temporary, and the reaction usually proportioned to the depression; hence the danger of giving any powerful stimulant. If there should happen to be laceration of the brain, which, as has been already stated, is a condition often existing in concussion, then the period of depression of circulation tends to diminish the danger of internal hemorrhage; and this furnishes an additional argument in favour of the practice of avoiding stimulants; whereas, if the circulation be artificially excited, there is greater danger of compression from internal hemorrhage, and of phrenitis; and it has been already mentioned that these are two of the ways in which concussion proves fatal. Mr. Guthrie's sentiments on this subject are given with his usual great clearness and decision. "It is useless to open the patient's veins, for they cannot bleed until he begins to recover, and then the loss of blood would probably kill him. It is as improper to put strong drink into his mouth, for he cannot swallow; and if he should be so far recovered as to make the attempt, it might probably enter the larynx and destroy him. If he be made to inhale strong stimulating salts, they will probably give rise to inflammation of the inside of the nose and throat, to his subsequent great distress."

In the second stage the object to be aimed at is, to moderate the reaction, and thus to prevent, if possible, the occurrence of the symptoms of the third stage. The patient should be placed in a cool, quiet, dark room, and every external source of excitement avoided; the shoulders should be a little raised; the head shaved, and cold applications applied to it; the bowels freely purged, and the diet of the most unstimulating kind. If there be any evidence of increased vascular action, it may be advisable to bleed from the arm; but on this point the surgeon must be guided entirely by the state of the pulse, and not by the insensibility, which cannot be removed by bleeding. After the proper restoration of the circulation, if there be evidence of increased vascular action, a moderate bleeding may prevent phrenitis; and, if there be laceration, it may tend to arrest extravasation of blood on the brain. When recourse is had to bleeding in this stage, it is chiefly as a precaution.

In the third stage, the treatment is the same as in ordinary cases of phrenitis, namely, depletion both general and local; the efficient application of cold to the head by means of evaporating lotions, or of water rendered very cold by ice, or of ice itself and water in a bladder; smart purging of the bowels, with low diet, and attention to all necessary precautions for avoiding light, noise, and everything which could prove a cause of excitement or irritation. Care, however, must be taken that bleeding be not carried too far. The following reasons suggest the necessity for caution:—

1. If there be laceration of the brain, the amount of inflammation necessary for obtaining reunion may be prevented. Sir Astley Cooper records a case which occurred in the practice of another surgeon, where depletion was carried too far, and on dissection there was found laceration, without any attempt at reunion.

2. Phrenitis is an inflammatory disease, in which it is well known that patients do not bear depletion to the same extent as in some other inflammatory attacks.

3. Repeated copious bloodletting produces of itself confusion of mind, pain of head, a hardness and jerking condition of pulse, giddiness, and other symptoms, which an inexperienced observer may mistake for the symptoms of the injury.

When the powers of life in this stage seem to be failing, recourse may be had to stimulants; and it is surprising how patients sometimes rally under them, in cases in which the symptoms are very unpromising, and death seems very near.

Throughout all the stages, the state of the bladder must be carefully attended to, and the catheter used, if necessary.

COMPRESSION OF THE BRAIN, OR COMA.

Symptoms.—In sanguineous apoplexy we have a good illustration of the symptoms of compression of the brain. In well-marked cases there is complete suspension of consciousness and of all mental operations. From the circumstance of the brain being incapable of receiving impressions from the nerves, there is suspension of the functions of the external senses, and of common sensation; and from its being unable to transmit the influence of the will through the nerves to the muscles, there is loss of voluntary motion. The muscles are relaxed, and the body remains in any position in which it may be placed. Both in compression and in concussion, sensation and voluntary motion are suspended; the characteristic difference is, that in the former, the suspension is constant and uniform while the compression continues; in the latter, there are, even during the continuance of the concussion, occasional fits of restlessness, and the symptoms have a tendency to wear off.

The retina is perfectly insensible; if the eyelids be opened and a candle be placed near, no perception of light is evidenced; the iris is motionless, and the pupil dilated. This is the condition of iris generally found, and, therefore, regarded as a symptom of compression, though sometimes the pupils have been found at first contracted and fixed, and afterwards dilated and fixed.

The respiration is slow, difficult, and stertorous. The relaxation of the velum pendulum palati, and of the muscles of the larynx and pharynx, prevents the free passage of the air, and gives rise to the noise in breathing called stertor. In very bad cases, the air puffs out the cheeks and lips, and elevates the latter in passing out; this is always viewed as an unfavourable symptom. In consequence of the insensibility, the uneasy sensation in the chest caused by the presence of venous blood in the lungs, which under ordinary circumstances excites respiration, is not felt; and, in addition to this, the muscles of respiration are paralysed. It is this condition of the respiratory apparatus which is the immediate cause of death; in other words, death is caused by asphyxia; and, therefore, the condition of respiration is watched by the surgeon with the utmost anxiety.

The pulse is for the most part slow, full, and labouring. It has already been stated that, although the action of the heart is independent of the brain, inasmuch as the whole of the brain of an animal can be removed, and if the respiration be kept up, the action of the heart will continue for some hours, yet it is disturbed by a sudden injury of the nervous system;—in concussion, for example, the heart's action is diminished, to a very great degree, in the manner already described; in compression, however, the pulse is affected in a different way. In concussion, it is weak, small, and fluttering; whereas in compression, it is slow, full, and labouring. The action of the heart is diminished, weakened, and sometimes entirely suspended by concussion, as by a sudden injury of the nervous system; whereas in compression, it does not seem to be at all affected directly, but to become impeded and interrupted, from the obstruction of circulation through the lungs, caused by the tendency to asphyxia. In the one case, the effect is produced directly on the action of the heart, in the other, directly on the action of the lungs, thereby rendering it more than ordinarily difficult for the heart to perform its function. Experiments of sawing out a portion of the cranium, and applying pressure to the brain, have been performed on the lower animals, to ascertain the effect on the pulse; and the result observed has been, that the pulse becomes slower and labouring when severe pressure is applied, and rises when the pressure is removed. The same effect is observed in injuries of the human body: when the brain is severely compressed by a depressed portion of bone, the pulse becomes slow, and it is observed to rise, and often very suddenly, when the pressure is removed. This effect, as has been already stated, is believed to be occasioned by the condition of the lungs. Some cases are recorded in which the pulse became exceedingly slow. Dr. John Thomson mentions a case of compression from fracture with depression, where it fell to thirty-six in a minute; and I had an opportunity of watching a case where it became as low as thirty-two. Though compression is usually characterized by the condition of pulse here described, some instances have occurred, where the other symptoms have been well marked without any perceptible change of circulation. Intermission of pulse, though observed in concussion, is not met with in compression.

The symptoms affecting the alimentary canal are, that there is loss of the power of swallowing, from paralysis of the muscles of deglutition; the bowels are constipated, and from the sphincter ani being paralysed, the fæces are passed involuntarily. Vomiting, which is usual in concussion, is very rare indeed in compression, it is only present under one or other of the following circumstances, namely, at the commencement of slightly marked cases, where it is probably owing more to concussion than compression; and in severe cases of compression, on the sudden removal of the cause of pressure, as on the removal of the depressed portion of the bone. Vomiting indicates a greater degree of sensibility and irritability than are generally met with in compression.

The bladder being paralysed, cannot pass off the urine. Unless death soon follows, this retention of urine, as pointed out by Desault, is succeeded occasionally by a dribbling or sort of incontinence of urine; for the bladder becomes so enormously distended, that the urine forces the sphincter to such an extent as to allow a small quantity to dribble off, yet not sufficient to relieve the distension, or to obviate the necessity for the introduction of the catheter.

Convulsive twitches are sometimes met with in individuals suffering under compression of the brain. According to Bichat and Brodie, these are not indications of compression, but are believed to be more frequently connected with laceration or wound of the brain than with any other condition.

Manner in which Compression proves fatal.—In describing the symptoms of compression it has been already stated, that it proves fatal by failure of respiration, or, in other words, by asphyxia. All sensibility being destroyed, the sensation caused by the presence of venous blood in the lungs, which is the stimulus to respiration, is not felt; the muscles of respiration are also paralysed. After death, the veins leading to the right side of the heart, the right side of the heart itself, and the trunk and branches of the pulmonary artery, are found greatly distended with venous blood, and the left side of the heart is empty. These conditions depend on the obstacle to the transmission of blood through the lungs caused by the failure of respiration. This is a different state of parts from what was described in cases where concussion proves fatal by failure of the heart's action.

There is another circumstance, in which the state of the heart differs very much in death from compression, and death from concussion.

In concussion, the heart's action seems to be completely destroyed, so that it cannot be excited to contract, although the chest of an animal be opened immediately after death, the irritability of the organ being destroyed; whereas in compression, if the heart, whose action in this form of death by asphyxia continues for a few seconds even after the last breath, be exposed immediately after death, it may be excited to contract, either by allowing some of the contents of the right side to escape, or by irritating it; thus showing that its irritability is not destroyed, as it is in death by concussion beginning at the heart. In compression, the action of the heart ceases at last, the right side being unable to contract from over-distension, and the left, from the want of its ordinary stimulus, the blood.

Causes and Treatment.—The causes of compression from injury are three; fracture with depression, extravasation of blood, and the formation of matter. For a description of the symptoms, diagnosis, and treatment of these three different conditions, I beg to refer to the sections on fracture with depression, and fracture of the internal table. I think it necessary here only to add, that extravasation may take place in any of the five following situations: first, between the cranium and dura mater; second, under the dura mater into the cavity of the tunica arachnoidea; third, between the tunica arachnoidea and pia mater; fourth, between the pia mater and the brain; and fifth, into the substance of the brain itself. There does not seem to be any difference in the symptoms, whatever be the situation of the blood; and it is only when it is in the first-mentioned situation, that relief can be given by trephining, because, in addition to other reasons, it is then only that its situation is circumscribed. I am aware of some extraordinary cases, where relief has been afforded by puncturing the dura mater; but notwithstanding these exceptions, the above, as a general rule, will be found to be correct. When suppuration takes place, it may be in any of the above-named situations. According to Pott, when the matter is between the cranium and dura mater, its existence is indicated by a puffy tumour of the scalp, and a separation of the pericranium from the outer table of the cranium. This condition does occasionally present itself; but it certainly is not an invariable symptom, as cases have occurred, in which this condition was not present, and yet on dissection, matter was found between the cranium and dura mater. That such is the case, Bichat says, is proved by daily experience at the Hôtel-Dieu. On the other hand, and lately in my own experience, I met with two cases in our hospital, where, during life, the patients had separation of the pericranium, a puffy tumour of the scalp, and a yellow dry portion of bone, and after death, there was no matter between the bone and dura mater, but in each case a deep abscess in the brain:—in one of the cases there was a clot of blood in the brain, no doubt the result of laceration during the fall which caused the injury. A discouraging fact connected with these cases is, that not unfrequently, when the matter is found between the bone and dura mater, the patient falls a victim to encephalitis, and it may therefore truly be said that the surgeon is beset with dangers on every side. Sometimes, however, patients are saved under very remarkable circumstances. Dupuytren had the good fortune to save a patient, whose case constitutes a remarkable exception to general experience. He plunged a bistoury into the substance of the brain, and relieved a patient from an abscess in the brain. Cases, however, of abscesses within the cranium very rarely indeed end favourably under any treatment. I have been struck with an observation by Hewitt, who says, "The successful termination of a case of trephining, for matter between the skull and dura mater, is all but unknown to surgeons of the present day."

But for whatever purpose trephining has been performed, the results are anything but flattering. Nélaton says, that trephining has been performed sixteen times in the Parisian hospitals during the last fifteen years, and all the cases have terminated fatally. In the hospitals in London, Dublin, Edinburgh, Glasgow, Aberdeen, and other large cities in Great Britain, the mortality, although very high, is much less; and in the United States, according to Lenter and Gross, the number of recoveries to the number of deaths is one to four.

CONDITIONS WHICH JUSTIFY THE OPERATION OF TREPHINING.

From what has been stated regarding injuries of the head, it will appear, that operative interference is thought to be justified under the following circumstances :—

1. In simple fracture with depression, provided the symptoms persist after the use of depletion, purging, and the other alleviating remedies.

2. In compound fracture with depression without symptoms of compression.

3. In punctured fracture without symptoms of compression.

4. When the symptoms are very urgent, and the surgeon thinks he has good reason to believe that they are caused by blood or purulent matter underneath the cranium and above the dura mater, or by fracture with depression of the inner table.

In each of the first three conditions, it is considered necessary to adopt proceedings for raising the depressed portion of bone to its proper level. If, on exposing the fracture, it is found that this cannot be done by means of the elevator, which is often the case, in consequence of the fractured portions being so related that it is impossible to insinuate the extremity of the elevator underneath the depressed portion, then it is justifiable to remove a small portion of the cranium by means of the trephine, for the purpose of allowing the introduction of the elevator, by which the depressed part is to be raised. The instrument used by the ancients was the trepan, and the operation was called trepanning; the instrument now used is called the trephine, and the operation, trephining.

Such are the views now entertained in these later and better times of surgery, as to the conditions which justify and require the operation of trephining. We find, however, from the history of surgery, that a very different doctrine prevailed in former days ;—that so great was the rage for trepanning among the ancients, that the very slightest fissure, or even the mere suspicion of one, was considered to be sufficient warrant for the operation ;—that they trepanned in all fractures, whether attended by depression or not, whether accompanied by symptoms of compression or otherwise ;—that they operated when bad symptoms were present, to remove them,—when absent, to prevent them ; so that they elevated every depression, trepanned every fracture, and, in operating on a longitudinal or a radiated fracture, they trepanned along the whole of its course, so as to saw it out ; and did not allow a single fissure of it, or rima, as they called it, to escape. In operating for the removal of a coagulum, they made as many openings as would uncover, if possible, the whole of it ; and, says Ravaton, "I have seen surgeons so infatuated, so desperately bent on discovering abscess on the dura mater, that, after applying six crowns of the trepan, they would, and I verily believe have, pulled away all the remaining bones of the cranium, had not their patients been delivered by death from such operations." All this was done, they said, to remove danger. It is almost incredible to what a disgraceful extent this passion for trepanning was allowed to outrage common sense ; and it is difficult to imagine how they could believe a fracture to be so dangerous, and their operations so safe. To show the extent to which trepanning was carried, Mr. John Bell gives the following quotation :—"Godifredus, Chief Surgeon to the States of Holland, mentions with particular exultation the performance of this operation by his friend, who trepanned the cranium of the Count of Nassau twenty-seven times ; and that the fact might be established on indisputable authority, he made the said Count of Nassau, after he was recovered, write the following curious certificate, on the 12th day of August, 1664 :—'I, the underwritten Philip Count Nassau, hereby declare and testify, that Mr. Henry Chadborn did trepan me in the skull twenty-seven times, and after that did cure me well and soundly.'" These practices, and the numerous inventions of instruments for cutting the skull, are sad monuments of the surgery of past ages. In later times, the Royal Academy of Surgery in France revived and defended the doctrine that all fractures of the cranium ought to be trephined. It does seem surprising that this body of men, convened for the purpose of ascertaining the principles which ought to regulate the practice of our science, and to whom surgery is in other respects so greatly indebted, should, by giving the sanction of their high authority to so dangerous a doctrine, have led the younger members of our profession to adopt very dangerous rules of practice. The unfortunate results of the operation were so numerous, that the celebrated Desault, one of the greatest ornaments of surgery in France, forming his opinion from what he saw at the Hôtel-Dieu, strongly condemned the practice, and, in the latter part of his life, entirely discarded it. The doctrine of the French Academy met with a most powerful advocate in this country, in the late Mr. Pott, who, with all the great talent and decision for which he was so eminently distinguished, maintained the doctrine of trephining in almost every fracture, to prevent, as well as to remove, bad symptoms. He states that fracture of the skull, in many cases, is not attended with any symptoms actually demanding this operation at the moment ; but that although there may be no symptoms denoting affection of the membranes, or of the brain itself, yet inflammation of those parts will, in consequence of the fracture, come on at a more or less remote period, and that, therefore, recourse ought to be had to the operation. Mr. Pott, in speaking of the doctrine of trephining, says, "I am as much convinced of this as of any fact which repeated experience may have taught me ;" and throughout his writings on that subject, he gives his opinion with so much decision, supporting it by cases and arguments, that his views cannot fail to have produced a very decided impression. Notwithstanding, however, all the eloquence and talent with which he supported his views, the doctrine he taught is now abandoned; and in these later and milder times of surgery, operative procedure is considered justifiable only under the circumstances mentioned at the commencement of this section.

HERNIA CEREBRI, OR FUNGUS OF THE BRAIN.

When a portion of the wall of the cranium has been removed by the trephine or otherwise, a portion of the brain is liable to protrude through the aperture, constituting the state called hernia cerebri, or fungus of the brain. When this state supervenes on external violence, it usually makes its appearance very soon, and its progress is pretty rapid. A case which I saw lately brought the following description of this state by Gross to my mind:—"The form of the tumour bears a considerable resemblance to that of a mushroom, the expanded portion overhanging the skull, while the narrow, projecting through the abnormal opening, is connected with the brain below. Guthrie has described two varieties of this disease—the one very rapid in its growth, taking place often in two days, and consisting chiefly of hemorrhage at the superficial part of the brain; the other of cerebral matter, infiltrated with more or less of lymph, having an ichorous discharge, and being in some cases studded over with fungous granulations. It is perfectly destitute of sensibility, it is elastic and compressible, and moves synchronously with the pulsations of the brain. The constriction at the aperture often causes sloughing, but the removal of the slough is rapidly followed by fresh rising up of brain and fungous granulations. In the very rapid cases, the mind is usually affected, death taking place early, and preceded by symptoms of delirium and phrenitis. In many cases, the mind remains clear and undisturbed for a considerable time, but in most instances there is more or less cerebral disturbance, indicated by incoherent answers to questions, and delirium. The countenance has a vacant expression; there are the usual symptoms of irritative fever; and towards the close coma and convulsions usually set in, and death takes place apparently, in most cases, from the conjoined effects of irritation and coma. On making a section of the recent and rapid form of growth, it is found to consist of cerebral matter and small masses of clotted blood, similar to apoplectic depôts of the brain; the slower variety consists of cerebral matter, with more or less of lymph, and a coating of fungous granulations. The cerebral substance in the neighbourhood of the tumour is discoloured, softened, and more or less infiltrated with a serous-like fluid."

Treatment.—Almost all that can be done, in addition to the regulation of diet, avoiding of all excitement, and maintaining an elevated position of the head, is to shave off the tumour, apply a pledget of lint wetted with liquor calcis or water, and, by careful pressure, endeavour to prevent reproduction. As prevention is better than cure, when an opening is made in the cranium, well-regulated pressure by means of soft oiled lint, compress, and bandage, should be carefully employed, with the view of giving natural support, and preventing protrusion of the brain.

WOUNDS OF THE BRAIN.

From what has already been stated, in describing the various injuries of the head, it will be understood that the brain may be wounded in any way by which fracture of the cranium is produced, and that it may be lacerated as the result of *contre-coup*, without any accompanying fracture. The wound may be incised, punctured, lacerated, contused, or gunshot, according to the character of the weapon or force by which it is produced. The most formidable wounds usually met with in civil practice are those which accompany compound fractures of the cranium.

The results of wounds of the brain present remarkable diversities. If the respiratory tract be involved, as in wounds of the medulla oblongata, immediate death will result, from failure of the process of respiration. Death may take place in a short time, or instantly, from failure of the heart's action, caused by the accompanying concussion; it may be gradual and in the way of coma, in consequence of extravasation of blood; or it may take place at a later period in the way of coma, the patient in the interval exhibiting the symptoms of encephalitis or of meningitis. On the other hand, it is very surprising to witness the recoveries that take place in some cases, and the length of time that patients live in other instances, where the brain is injured to a very great degree. Children especially are often seen to live for a considerable time after most serious injury of the brain, and some have been known to bear the loss of considerable portions of the brain without any very serious consequences. I am about to dismiss a patient from our hospital who had a wound an inch and a half long in his brain, and the cerebral matter brought distinctly into view. I saw a man in our hospital some years ago, under the care of one of my colleagues, whose skull and brain were divided extensively in front by means of a circular saw, with which his head came into contact while the saw was in rapid motion sawing timber. The man left the hospital perfectly well. Foreign bodies of large size have sometimes been lodged in the brain for a considerable time without causing death. Hennen states, "that he has seen five cases in which bullets were lodged within the cranium that did not prove immediately fatal." Dr. Cunningham relates the case of a boy who lived for twenty-four days with the breech of a pistol, weighing nine drachms, lying on the tentorium. Dr. O'Callaghan has recorded the remarkable case of an officer who lived about seven years with the breech of a fowling-piece, weighing three ounces, lodged in the forehead; the right hemisphere of the brain resting on the flat part, from which it was only separated by false membrane. Wounds of the brain are not attended with any special symptoms besides those that result from concussion, inflammation, or compression of the brain.

The treatment consists in the removal of any foreign body, if practicable, the use of simple dressings, the prudent employment of antiphlogistic treatment, and carefully guarding against every source of excitement and irritation.

CHAPTER X.

DISLOCATIONS.

By a dislocation is meant the removal of the articulatory surface of a bone from the part with which it is naturally in contact.

There are few bones in the body that may not be displaced by the application of enormous force; but there are some,—as, for example, the vertebræ, and the bones of the pelvis, carpus, and tarsus, so firmly joined together, that although by extreme violence the ligaments and other structures by which they are so powerfully tied together and maintained in their natural relations, may be injured to such an extent as to admit of the bones being displaced, yet the application of extreme force in such cases produces other effects of so dangerous and destructive a character that the separation of the bones is a matter of inferior importance. The articulations which are principally subject to dislocation are the ginglymoid and the orbicular; more especially the latter. The reason of this difference will at once be perceived, on observing in the ginglymoid joints the mutual correspondence of the eminences and depressions of the bones, the number, strength, and firmness of their ligaments, and the configuration of the parts, which, like a hinge, admits of motion only backwards and forwards in a single plane; whereas, in the orbicular joints the very shape of the bones, the comparatively loose condition of the ligaments, and the formation of the joints such as to allow very extensive and diversified movement, all contribute to increase the liability to dislocation.

Dislocations may be complete or incomplete, accidental or spontaneous: that is, the articular surfaces may be either completely, or only partially separated from each other; they may be caused by external violence, when they are called accidental; or, in consequence of disease in a joint, the bones and ordinary ligamentous restraints may be so destroyed, that the common actions of the muscles produce the displacement of the bones without any external violence. This spontaneous dislocation is met with in the hip and in the knee: but, as in this part of the work we are considering the separation of the ends of bones caused by external violence, we shall defer any further reference to spontaneous dislocation until we come to describe the phenomena connected with the diseases of joints. An incomplete dislocation is of comparatively very rare occurrence in the orbicular joints, but in the ginglymoid it is frequent, from the very great breadth of articulating surfaces.

Another arrangement, which in a practical point of view is of great importance, divides dislocations into two classes, simple and compound. A dislocation is said to be simple, when the articulation is not laid open; and compound, when the head of a bone is not only dislodged from its articular cavity, but forced through the integuments, or complicated with a communicating wound of the soft parts extending into the joint.

In treating of simple dislocations we shall consider—

I. The causes of dislocation. — II. The symptoms. — III. The general indications of treatment.—IV. The consequences of an unreduced dislocation.

I. The *Causes* of dislocation may be arranged into predisposing, and exciting. To the former belong shallowness in the form of a joint; great looseness of its ligaments; great latitude of motion; weakness of surrounding muscles, whether from emaciation and debility, or from paralysis; weakness and relaxation of the soft parts from previous dislocations; unusual distension of a joint from an inordinate accumulation of synovia; and destruction of the ordinary organs of relation from disease. The exciting causes are external violence and excessive muscular exertion. Of these many examples might be given. External violence may be applied directly or indirectly; for an example of each we may mention two ways in which the shoulder is dislocated. Dislocation downwards of the shoulder is sometimes produced by violence applied to the upper part of the humerus, by which the head of the bone is directly forced down into the axilla; and sometimes by the indirect application of violence, as when by a fall, or by other means, the elbow is forcibly raised upwards, and the head of the bone is thus driven against the under part of the capsular ligament. The displacement of the patella will furnish an illustration of the manner in which excessive muscular action may give rise to dislocation. The natural position of the patella is such, that it prevents the fibres of the rectus muscle from going in a straight direction from their origins at the pelvis to the anterior tuberosity of the tibia, into which they may be considered as being inserted through the medium of the fibrous covering on the front of the patella and the ligamentum patellæ. The bone, preventing these fibres from going in a straight direction from the pelvis to the leg, causes them to describe an arch, the convexity of which is inwards. When the muscle is violently called into action, it will have a tendency to draw the patella outwards, in its endeavour to pass straight to the tibia, and thus a dislocation outwards is often produced. If the muscle be violently called into action while the knee is bent inwards, a dislocation will be still more likely to ensue. At the temporo-maxillary articulation, a dislocation is often caused by muscular contraction, as will be afterwards explained.

II. *Symptoms.*—One of the most constant and characteristic symptoms of dislocation, and one which seems to distinguish this injury from fracture, is the fixed condition of the limb. In some cases there is absolute immobility of the limb, so that it cannot be moved either by the voluntary efforts of the patient, or even by the surgeon. This complete immobility is usually found in joints which move only in a single plane; for example, it is particularly observed in dislocation backwards of the elbow. In other cases, although the muscles about a joint cannot excite motion, the limb may be very slightly moved in one particular direction; for instance, in some cases of dislocation downwards of the humerus into the axilla, the arm can be raised upwards to a certain extent by the surgeon, while it may be perfectly immovable in every other direction. But slight mobility in one direction, though occasionally observed, is not found in many instances, and therefore a fixed condition of a limb may be considered as a general symptom of dislocation. Sometimes the mobility is not entirely lost for two or three hours after the accident, or even longer. This is believed to arise chiefly from the muscles requiring some time to shorten, and accommodate themselves to their altered condition, and partly from the irritation and inflammation caused by the unnatural position of the bone. The patient feels more pain and tenderness in consequence of the irritation and inflammation, and, therefore, naturally offers greater resistance to any moving of the limb. A second symptom particularly deserving of notice, is the unnatural direction of the axis of the bone. This is a striking symptom, and to be especially observed. As a good example, we may mention dislocation downwards of the shoulder in which the axis of the humerus is directed into the axilla, instead of being in its natural position. This symptom presents itself immediately on the occurrence of dislocation, and remains until reduction is effected. A third, and very frequent symptom, is some alteration in the length of the limb. The dislocated extremity is in most instances shortened, but is sometimes lengthened; as in dislocation downwards of the shoulder, and dislocation downwards of the hip. In the under extremity, the presence or absence of this lengthening is a good diagnostic symptom between dislocation and fracture; for it is found in dislocation downwards of the hip-joint, but never occurs in any fracture of the under extremity. A fourth symptom is some unnatural appearance about the joint, by which its shape is changed. These alterations of form differ, of course, in different dislocations. A fifth symptom is slight, soft crepitation, or a simulation of crepitus. This is a symptom of which the practitioner ought to be well aware, lest he be deceived by it, and led to mistake a dislocation for a fracture. The crepitation in dislocation is of a soft, crackling, oozy, sloppy character, easily distinguished from the hard grating crepitus of fracture, and is supposed to arise from the escape of synovia and serous effusion into the surrounding cellular tissue. Sometimes, however, there is in dislocation a hard crepitus, in consequence of small osseous scales being torn off from the bone where the muscles are inserted into it. In addition to the above symptoms, there are sometimes great swelling, pain about the joint, great pain at the extremities of the nerves, the trunks of which may be pressed by the head of the bone. There may also be numbness, or even paralysis of the limb, if the pressure on the nerves be to a great extent; and œdema, if the pressure be on the vessels returning blood from the extremity.

III. *Treatment.*—In the treatment of dislocations the indications are three :—

1. To restore the bone to its natural situation : this is termed reduction.
2. To preserve the parts reduced in their natural position, until the lacerated ligaments have had time to unite.
3. To prevent unfavourable symptoms, or if they have already occurred, to remove them.

The first and paramount indication is reduction, which should be immediately attempted; for it becomes increasingly difficult with the length of time from the occurrence of the dislocation, and is, after a long interval, altogether impracticable. It is universally agreed, that the chief impediment to the reduction of a recent dislocation is muscular action. Some muscles, having their extremities brought nearer to each other than is natural, become permanently contracted, and accommodate themselves to their new condition. The proofs of this are found in the facility with which reduction is accomplished, when the accident has happened in a limb affected with paralysis, or in a weak, relaxed, and emaciated person; or when the muscles are incapable of making much resistance through any great temporary weakness, or extreme prostration, or collapse, or through the patient being faint, or under the influence of chloroform.

The condition of the parts about the joint differs at different periods, if it be long before reduction is attempted. Immediately after the accident, the muscles are relaxed, from the depression of the system, principally caused by the shock of the injury; and this condition is very favourable for reduction : soon, however, they become spasmodically rigid, and ultimately, if reduction be not accomplished, they become completely adapted to their altered condition; the laceration of the ligaments is gradually filled up by the effusion of adhesive lymph, and if the ligament be a capsular one, with a rent, through which the head of the bone has escaped, the diminished size of this opening from the effusion of lymph will, in time, present a further obstacle to the return of the bone into its natural situation. To overcome the contraction of the muscles, extension and counter-extension are employed. It must be manifest, that simply drawing or extending the limb would not have much effect on the muscles around the joint; but that to make the whole force bear upon them, both extension and counter-extension are to be used. For instance, when you have to reduce a dislocation of the shoulder, you first fix the scapula; in other words, you use counter-extension. You next apply the extending force to the arm; but this without counter-extension at the same time would answer no useful purpose, for the extending force, instead of acting on the muscles around the joint, would act on the whole body; so that counter-extension, that is, the fixing of the body, is obviously just as necessary as the application of force to the bone which has been dislocated.

By British surgeons, extension and counter-extension are applied as near as possible to the dislocated joint: for example, in dislocation of the hip, the counter-extension is applied to the pelvis, and the extension to the thigh; because the whole force is thus directed against the muscles which oppose the reduction.

A point of considerable importance is, the best method of using extension; whether short and violent efforts should be made, or whether the force should be continued even and uninterrupted. On this subject Professor S. Cooper remarks:—"The invariable maxim in reducing dislocation is, not to make the extension with sudden and considerable violence, but gradually, and, at the same time, steadily and unremittingly. It is safer to tire out the opposition of the muscles by gradually increased uninterrupted force, than by resorting to short efforts of great violence. In this latter practice you run the risk of producing considerable mischief; you may rupture arteries and veins; you may contuse and injure important nerves; or you may lacerate the soft parts. But with all these objections, you would gain nothing, for you would have less chance of getting the bone into its place, than by a milder and more judicious plan. The principle, I repeat, then, is to make the extension slowly and gradually, and at the same time unremittingly; for no muscles, however powerful they may be, can resist force thus employed against them, beyond a certain time, and they must, eventually, become tired out." The manner in which extension and counter-extension are employed, varies in different dislocations, as will afterwards be observed, when the dislocations are described.

In employing extension, the greatest care is necessary so to apply it that as little injury as possible may be caused to the soft parts. With this object, various means are taken to avoid bruising or excoriating the part to which the force is applied; a few turns of a roller, wetted, that it may be less apt to slip, or a portion of soft wash-leather, or a damp towel, may for this purpose be put round the part to which the extension is to be applied. This having been done, let a loop, or noose, formed by doubling a band of linen or, which answers as well, of stout worsted, be fixed on the part of the limb thus protected, and the ends be drawn through the noose; to these ends the force employed, which is usually the muscular power of assistants, is applied. The preferable way of applying the noose, is to fix it by means of what is called the clove-hitch; the advantage of which is, that while it holds firmly enough, it cannot be tightened by the pulling so as unduly or dangerously to constrict the limb. Instead of a noose, a circular band, tightened by a screw, is sometimes used; but the former is more convenient and efficient. The force should be thus applied, while counter-extension is being applied above the joint. The different ways of using counter-extension suitable to special dislocations will be afterwards described.

In some dislocations the muscular power of assistants is insufficient; and in such cases the necessary force is applied by means of pulleys. These, being so constructed as to afford great mechanical power, enable the operator to carry the extension to any degree he may think judicious, without the risk of any relaxation or diminution of the force. When they are employed, a well-padded belt is fixed round the limb, having two straps with rings attached to it; the hook of one set of pulleys is fixed to the rings, while that of another is fixed to some ring, staple, or other resisting object in the room, and an assistant pulls the cord, to which in this method of reduction the whole power is applied.

The obstacles to reduction are sometimes so considerable, that it is necessary to employ some previous measures to diminish the power of the muscles. This is usually required in attempting to reduce dislocations of long standing, or in the case of robust persons, and in dislocations of the hip-joint, where the resistance is always very considerable. The means formerly employed for this purpose were, venesection, or nauseating doses of antimony, or the warm bath; but of all the auxiliaries to extension and counter-extension chloroform is the most powerful, and it is now invariably preferred. It prevents pain, facilitates reduction, renders comparatively little force effectual, thereby diminishing the danger of injuring texture, and leaves no permanent weakness of system. When extension and counter-extension are being employed, the surgeon should use the dislocated bone as a lever, and endeavour to press the extremity of it in the direction most calculated to promote reduction; but this should not be attempted until extension and counter-extension have been used for some time.

For fulfilling the second indication, that is, to prevent the recurrence of dislocation until the ligaments have had time to unite, the joint should be kept at rest, in the attitude in which a return of the dislocation is least likely to occur in some instances, and, with a degree of support, which, however, must depend on the situation of the articulation. The ligaments are more or less lacerated, and require time to heal; and the surrounding muscles, being not unfrequently torn from their insertions, must be kept at rest until they regain their attachments, otherwise the joint will remain weak in after life.

The third indication is to prevent, or remove unfavourable symptoms; for the former purpose, rest of the joint and the antiphlogistic regimen are required; for the latter, antiphlogistic remedies proportioned to the age and strength of the patient, and the violence of the symptoms.

IV. *The consequences of an Unreduced Dislocation* are important, and in some instances the resources of nature in forming an artificial joint are considerable. They seem, however, to be much more effective in some articulations than in others; in the orbicular, for example, than in the ginglymoid. In the one case, the power of motion is often regained to a considerable extent; whereas, in the other, it is almost, or sometimes even entirely, lost. In orbicular joints the very form of the bone gives a facility of moving, and if the displaced head rests on a muscle, the muscle becomes dense, hollow, ligamentous, smooth, lubricated, and of a suitable form for its reception. If it rests on a bone, as, for example, on the ilium or scapula, a cavity is formed to receive it, partly by absorption of part of the bone on which it rests, and partly by the deposition of new bone; and the cavity is either lined with a dense ligamentous matter, or covered with a porcellanous deposit. A cup is thus formed for the reception of the head of the displaced bone, which loses its cartilage, and generally becomes covered over by the porcellanous deposit, which gives a smoothness to the movement of the parts on each other. The surrounding cellular tissue becomes condensed, and, although less dense and firm than the original capsular ligament, yet it serves to connect the parts of the new articulation with each other, and assists in preserving them in the necessary relations. Subsequently, and always after the lapse of a considerable period, the original cavity for the reception of the head of the bone becomes changed, and ultimately very much diminished by the disappearing of its cartilage, the gradual filling up of its centre, and the rounding off by absorption of its edges. These changes take place earlier, if the new cavity be so situated as to encroach during its formation on the old one. In some cases the new cavity has been found so completely to surround the head of the bone, that it was impossible after death to remove the head without fracturing some part of the artificial joint. The resources of nature in remedying the effect of an unreduced dislocation are by no means so great, when the accident occurs in a ginglymoid articulation. The configuration of the bones is such, that the displaced bone cannot play so easily on the parts with which it is brought into contact; and the bones are held so firmly by their connexions as not to admit of much motion; hence, more or less of bony anchylosis has been found on dissection to be the general result. It is evident, therefore, that the consequences of an unreduced dislocation materially differ, according to the nature of the articulation to which the accident has happened.

COMPOUND DISLOCATIONS.

When a bone is not only displaced from the articular surface with which it is naturally in contact, but is also protruded through the external coverings, or when, in addition to displacement, laceration exposes to view the cavity of the joint, the injury constitutes a compound dislocation, which bears the same relation to simple dislocation, as compound fracture bears to simple fracture. A compound dislocation may also be complicated with fracture or severe contusion of the bones, extensive laceration of the soft parts, rupture of blood-vessels, or laceration of, or pressure upon, nerves. These complications are very formidable, and excite the greatest anxiety in the mind of the surgeon. At one time, they were considered cases for amputation; but now a surgeon would not think himself justified in advising amputation from the mere circumstance of a dislocation being compound. Petit and Pott inculcated the necessity of immediate amputation, and the practice was for a long time almost invariably adhered to, both in this country and in France; but the experience of Sir Astley Cooper, the late Mr. Hey, of Leeds, Mr. Lawrence, Mr. Liston, and of every practical surgeon of eminence in the present day, justifies a different procedure. In determining on the necessity of amputation, the surgeon is guided by the extent and nature of the complications, the situation and size of the articulation, and the constitution of the patient. The circumstances which warrant amputation are,—very serious complications, such as dangerous contusion and extensive, and more especially comminuted, fracture; rupture of important arteries; very great laceration of soft parts, so that the joint to a great extent must remain open; and a weak or irritable constitution. The case is also more unfavourable, if the articulation be in a part of the body where, by reason of the distance from the centre of circulation, the process of repair must be feeble. Such are the general considerations to be taken into account in judging of the propriety and necessity of amputation; but in every particular case, the surgeon must be guided by the particular circumstances, as it is impossible to lay down such a general rule as would enable him to decide in every one that may arise. When amputation is deemed necessary, the proper time for its performance is immediately after the patient has recovered from the collapse caused by the injury, and before inflammatory symptoms and accompanying irritative fever have commenced. The only other period at which it can be performed is not only much less favourable, but is also one which may never arrive; namely, when the above symptoms have subsided. The question, therefore, whether or not a limb is to be preserved, is one which calls for an early decision. When such cases terminate fatally, it is usually either at an early period by gangrene, or by irritative fever, or, at a later period, by hectic fever from the continuance of local suppuration and irritation, or from erysipelas, phlebitis, or pyæmia. After the subsidence of the irritative fever, while the patient is hectic, amputation may be performed; but after the constitution has been weakened by the previous symptoms, there is much less prospect of a favourable result. The two dangers which the surgeon has to consider in determining the treatment in the first instance, are, on the one hand, unnecessary mutilation if the limb be amputated, and, on the other, the risk of life from gangrene and irritative fever, if amputation be not performed. In persons of sound constitution, compound dislocation is often treated successfully; and sometimes they recover from very formidable injuries of this description with very considerable motion of the injured joint.

When an attempt is to be made to save the limb, the bones should be reduced, the edges of the wound brought together, and preserved in apposition by stripes of adhesive plaster applied in such a manner as not to excite any irritation by pressure; every effort should be made to obtain adhesion of the soft parts; and the local and constitutional symptoms should be combated by the appropriate remedies.

PARTICULAR DISLOCATIONS.

DISLOCATIONS OF THE LOWER JAW, OR TEMPORO-MAXILLARY ARTICULATION.

The temporo-maxillary articulation is liable to three dislocations, namely—

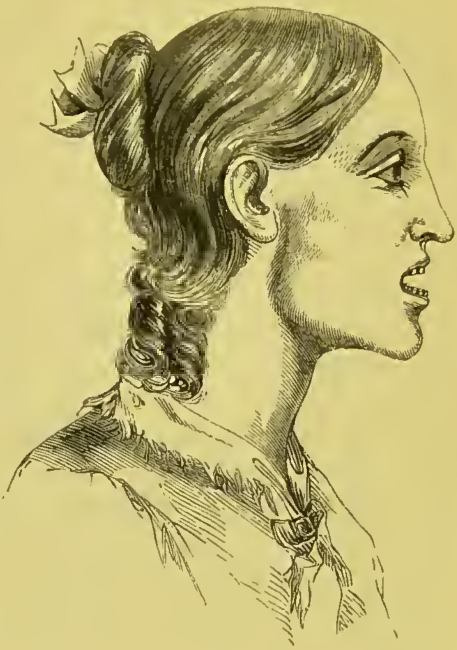
1st. Complete dislocation on both sides; 2nd. Complete dislocation on one side; and 3rd. Partial dislocation of the temporo-maxillary articulation.

COMPLETE DISLOCATION ON BOTH SIDES.

Causes.—This dislocation may be caused by a blow upon the chin when the mouth is opened wide; by yawning; by spasmodic action of the external pterygoid muscles, while laughing; by spasmodic action of the same muscles, during the extraction of a tooth,—of which the celebrated Mr. Fox, the dentist, met with an example; or by violently or suddenly opening the mouth very wide to receive too large a body,—of which Sir Astley Cooper records a case,—that of two boys struggling for an apple, the one of whom, attempting to force it into his mouth, dislocated his jaw. When the condyloid process is in its natural position, it rests behind the inferior root of the zygoma, which forms the anterior part of the condyloid fossa; but it may be drawn over this root by the external pterygoid; and this is more likely to happen, if the mouth be wide open, when the external pterygoid contracts. The rationale of this must at once be evident to every one who knows the action of the pterygoid muscles.

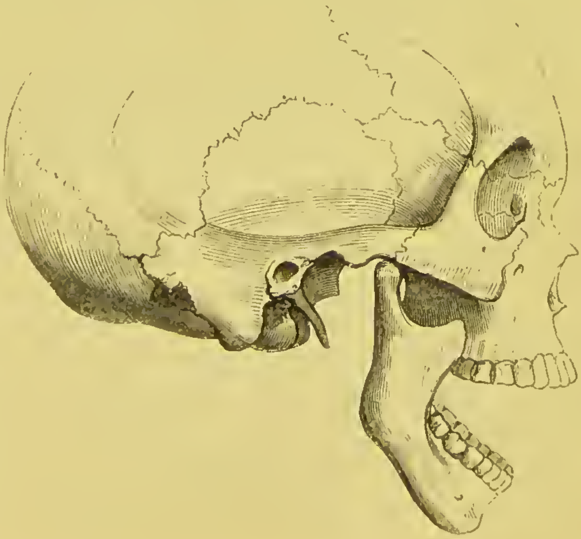
Symptoms.—The patient is unable to close the mouth. At first there is a considerable distance between the front teeth of the upper and lower jaw-bones, sometimes as much as an inch and a half; but afterwards the jaws can be brought closer, although the mouth still remains open, in consequence of the mechanical obstruction presented by the relation which is produced between the coronoid process of the lower jaw, and the under part of the malar bone. The functions of speech and of deglutition are interrupted; and the salivary glands being irritated by the pressure, there is consequently a great secretion of saliva, which, from the loss of deglutition, dribbles over the chin. If the lower teeth could be brought up, they would be found much in advance of the upper. The pain in some instances is not very great; in others, excessive. The cheek is stretched and flattened; the angle of the lower jaw is too near the mastoid process of the temporal bone, and a preternatural depression may be felt in front of the external auditory foramen, occasioned by the removal of the condyle from its natural situation.

Fig. 90.



State of the parts.—The condyloid process, instead of being in its natural situation, that is, in the condyloid fossa, the articular cavity of some writers, behind the inferior root of the zygoma, called by some the articular eminence, is brought forward in front of this eminence; and as the combined action of the external pterygoid muscles, which have one of their insertions into the pterygoid fossa immediately beneath the condyloid

Fig. 91.



process, is to bring forward the jaw, it is easy to perceive how the dislocation may be produced by the spasmodic contraction of these muscles.

The coronoid process of the lower jaw is inferior to the under part of the malar bone, and pressing against it, presents the mechanical obstacle to the closing of the mouth, which has been already referred to.

Treatment.—Various methods of reduction have been adopted. One is to introduce the thumbs, and with them to depress the molar teeth, while the chin is elevated by the fingers: by this means the condyles are depressed, and sent backwards into the cavities in which they are naturally situated. Another method is that employed by Mr. Fox, who placed a piece of wood about a foot long upon the molar teeth; then raising the end which he held in his hand, and using the teeth of the upper jaw as a fulcrum, thus depressed the end which was on the teeth, thereby accomplishing reduction on one side; and afterwards, in the same manner, he reduced the dislocation on the other side. A third, and by far the most elegant method, is that recommended by Sir Astley Cooper, namely, to place a cork on each side, between the molar teeth of the upper and lower jaw-bones as far back as possible, and then to press up the chin with the hand. The corks act as fulcra, the lower jaw as a lever, and the hand applied to the chin as the power. By raising the chin, the condyles are pressed downwards and backwards, and are thus sent over the articular eminences into their natural situations. Dislocations of considerable standing have been reduced. Stromeyer reduced one of 25, and Donovan one of 90 days' standing.

COMPLETE DISLOCATION ON ONE SIDE.

By this is meant a dislocation in which the condyloid process advances over the inferior root of the zygomatic process, or articular eminence, on one side.

In this dislocation the mouth cannot be closed, but it is not so widely opened as in dislocation on both sides; the chin is generally twisted to the opposite side, and the incisor teeth are not in a line with the axis of the face. From a consideration of the structure of the parts, we should expect, that in every instance of this injury the chin would be evidently turned towards the opposite side; but Mr. Hey, of Leeds, says, "I have repeatedly seen the disease when I could discern no alteration in the position of the chin. The symptom which I have found to be the best guide in this case, is a small hollow, which may be felt behind the condyle that is dislocated, which does not subsist on the other." The other symptoms, the state of the parts, and the treatment, are precisely the same as in the preceding injury, except that in reduction, the cork, or lever of wood, or pressure with the thumb, should be used only on one side.

To depress both condyles is found, as was first mentioned by Mr. Hey, to have a tendency to prevent reduction; and this, no doubt, explains what several surgeons have experienced, namely, that reduction is more easily accomplished by using the lever of wood, than by other means when the injury is on one side. After reduction, the jaw should be for some time supported by a bandage, and the patient should be careful not to open the mouth wide for a considerable period. Care, indeed, will be ever afterwards necessary in opening the mouth; for when the injury has once happened, a very slight cause will be sufficient to reproduce it.

PARTIAL DISLOCATION, OR SUBLUXATION, OF THE JAW.

The signs of subluxation are, a sudden locking of the jaw, the mouth being opened slightly and more widely in general on the affected side, and pain at the articulation. The symptoms do not depend on the displacement of the bones from each other, but on the inter-articular cartilage slipping from its proper relation to the condyloid process in consequence of relaxation, especially of the external lateral ligament. It is met with in persons of a relaxed habit of body, and is usually removed by the natural efforts to open or shut the mouth; but when these do not succeed, the back part of the jaw should be pressed directly downwards, so that the condyloid process being depressed, the cartilage may be replaced in its proper relation to it. In one instance, after this plan had failed, remembering the attachment of the external pterygoid muscle to the inter-articular cartilage as well as to the pterygoid fossa, I desired the patient to make an effort to bring forward the lower jaw, and the effort very speedily removed the subluxation. Young women of relaxed habit often experience a painful snapping at the joint while opening and closing the mouth. This, it is believed, is occasioned by the ligament failing from relaxation to preserve the parts in their due relations; and the best remedies for its removal are the means most likely to increase the tone of the parts, and to improve the general health and strength. The shower-bath, preparations of iron, together with other treatment for the general health, have been useful, and in obstinate cases a blister in front of the ear has been found to produce the desired effect.

DISLOCATION OF THE CLAVICLE AT ITS STERNAL EXTREMITY.

Of this articulation four dislocations have been known; but two of them are so extremely rare, that of one Sir Astley Cooper, in his vast experience, never met with an example, although he records a case in the practice of another surgeon, in which the dislocation was caused, not by external violence, but by disease; and of the other, so far as my reading extends, I have found but one example.

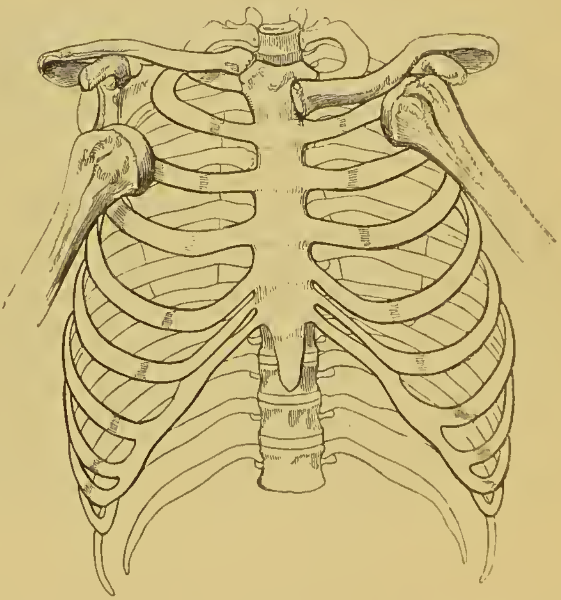
The four dislocations are arranged in the following order, according to the direction of the clavicle :—

1. Dislocation forwards, in which the clavicle is thrown forwards on the sternum ; 2. Dislocation upwards ; 3. Dislocation backwards ; 4. Dislocation upwards and inwards.

Symptoms.—In dislocation forwards, there is an unnatural tumour, or obvious deformity in front of the sternum, which may be made to disappear by drawing the shoulders backwards ; but it returns as soon as the force is removed ; the distance between the acromion process and the mesial line is diminished ; the head is drawn forwards, and turned *from* the affected side to relax the sterno-cleido-mastoideus muscle ; and there is inability to raise the upper extremity. The clavicle rests on the front of the sternum. A partial dislocation in this direction has been met with, in which the clavicle is not removed from its articulation with the sternum, the ligaments not being sufficiently lacerated to admit of complete displacement ; but it projects unnaturally forwards.

In dislocation upwards, the symptoms differ from those of the last dislocation merely in the situation of the unnatural swelling, which in this instance is in the under part of the neck ; in the other, on the front of the sternum.

Fig. 92.



This figure is intended to represent dislocation of the sternal extremity of the clavicle, and dislocation forwards of the shoulder joint on its left side ; and dislocation of the acromial end of the clavicle, and dislocation of the shoulder downwards on its right side.—From COOPER.

In dislocation backwards, there is an unnatural depression in the ordinary situation of the sternal extremity of the clavicle. It may also be accompanied by dyspnœa from pressure on the trachea, by dysphagia from pressure on the œsophagus, and by impeded circulation and pain from pressure on the vessels and nerves. This dislocation is so very rare, that Sir Astley Cooper says he never met with a single case as the result of injury, but refers to a case which occurred in the practice of Mr. Davie, surgeon at Bungay, in which the dislocation was caused by the bone being pressed forward at its outer extremity, arising from deformity of the spine. In this case, Mr. Davie was obliged to saw off the inner extremity of the clavicle, in order to relieve the dyspnœa and the other distressing symptoms caused by the pressure on the parts at the under portion of the neck. It has, however, been since ascertained that this injury may be produced by violence, and in the "Medical and Surgical Journal" for October, 1841, several cases are recorded. The ligaments in this dislocation are more or less ruptured.

Treatment.—In dislocation forwards, the surgeon should endeavour to bring forward the outer extremity of the clavicle, at the same time pressing backwards the inner extremity. In many instances the clavicle has been drawn off the sternum by pulling the shoulder backwards.

In dislocation backwards, it is necessary to draw the shoulders very much backwards, and as far as possible from the sternum. In all these dislocations the clavicle may be drawn outwards by drawing the shoulder outwards. In dislocation upwards, after the shoulder is drawn outwards, the surgeon should raise the outer and depress the inner extremity of the clavicle. For preserving the bone in its normal situation, and at perfect rest, the best retentive apparatus is that used in fractures. The cure is seldom so complete as in dislocations of other joints, and often some deformity remains, in consequence of the ligaments not properly uniting. Professor S. Cooper gives the following particulars of the dislocation upwards and inwards. He says,—"My friend, Mr. Morton, of University College, has favoured me with the particulars of an unusual dislocation of the sternal extremity of the clavicle, the displacement of it being upwards and inwards. Etienne Caréron, æt. 39, mason, admitted into the hospital of La Charité, on account of an injury which was caused by his having been violently squeezed between a wall and a cart, in such a manner that the left shoulder was thrust inwards with great force. On examination, the sternal extremity of the clavicle was found to have been displaced from its natural situation, and was now placed above the upper edge of the sternum, producing a slight deformity in the contour of the lower part of the front of the neck. It seemed from the description of the accident which was given by the patient, that the force producing the injury had acted in such a direction as to push the sternal extremity of the dislocated bone upwards and behind the sternal portion of the sterno-cleido-mastoid muscle. The articular surface of the internal extremity of the dislocated clavicle lay opposite to that of the clavicle of the sound side, and was supported by the superior border of the sternum. The attachment of the sterno-cleido-mastoid muscle to the first bone of the sternum did not appear to have suffered any laceration. M. Velpeau considered it to be very probable that the dislocation was in the first place backwards, but that the force continuing to act, the end of the clavicle was afterwards driven upwards and across the front of the root of the neck, and behind the sterno-cleido-mastoid muscle. The dislocation was reduced in the usual manner, and the apparatus of Desault for fractured clavicle employed to retain the bone in its proper place. The bandages used were steeped in a solution of 'dextrine,' which when dry rendered the whole immovable."

DISLOCATION OF THE CLAVICLE AT ITS SCAPULAR EXTREMITY.

The scapular extremity of the clavicle is liable to two dislocations, namely, upwards, in which it rests above, and downwards, in which it is placed underneath the acromion process of the scapula.

DISLOCATION UPWARDS.

Symptoms.—Diminution of the space between the apex of the acromion process and the central point of the sternum; an obvious deformity produced by the outer extremity of the clavicle, which, according to Sir Astley Cooper, may be best ascertained by tracing the spine of the scapula from within outwards; in doing which the finger will be interrupted by the outer extremity; inability of the patient to raise the arm; and unnatural flatness of the shoulder. By drawing the shoulders very forcibly backwards, these symptoms may be made to disappear for the time.

State of the parts.—The superior and inferior acromio-clavicular ligaments are ruptured. The peculiarity of the displacement is, that when the two portions of the coraco-clavicular ligaments are ruptured, the falling down of the shoulder is greater than if the two proper ligaments be ruptured.

Treatment.—The object is to bring the shoulders backwards. Sir Astley Cooper recommends the surgeon to place his knee between the shoulders of the patient, and forcibly draw them backwards and outwards. According to Mr. Liston, the best retentive apparatus is the same as for fractured clavicle; and which must be continued for many weeks, as the ligaments are slow in uniting. In dislocation of either extremity of the clavicle, even when treated by the most experienced surgeons, some deformity will almost always remain; but the patient will recover the motion of his arm.

DISLOCATION DOWNWARDS.

This is an extremely rare dislocation, so much so, that Nélaton states there are but three cases on record. Several other cases, however, have lately been recorded; and some months ago an example came under my own observation, in which the injury was caused by a fall on the point of the shoulder. The dislocation is easily distinguished, and the retentive apparatus used for fractured clavicle will be found convenient for maintaining the parts in proper position. In the case I met with, Brasdor's corslet answered more perfectly along with a sling and a bandage for keeping the arm close to the side.

DISLOCATION OF THE SHOULDER JOINT.

The number of dislocations to which the shoulder joint is liable, though usually stated to be four, we shall find to be five, three of which are complete, and two partial. The direction of the humerus is made the basis of the nomenclature.

1. Dislocation downwards, or downwards and inwards, or into the axilla, or subglenoid; 2. Complete dislocation forwards, or subclavicular; 3. Partial dislocation forwards, or subcoracoid; 4. Dislocation backwards, or subspinous; 5. Partial dislocation upwards.

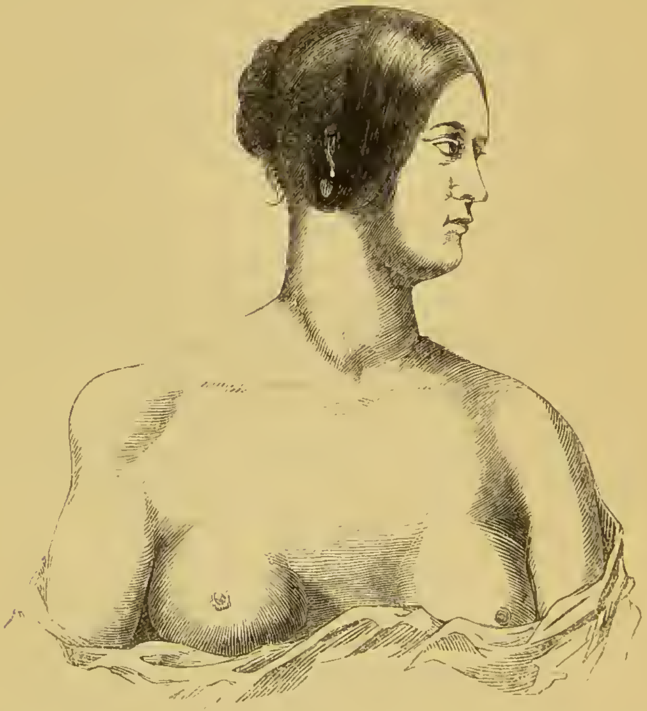
With regard to the comparative frequency of these dislocations, it has been ascertained that the first occurs most frequently; the second and third are not so common; the fourth is very rare; and of the fifth, not more than one or two cases are recorded.

I. DISLOCATION DOWNWARDS.

Exciting Causes.—A fall from a great height upon the top of the shoulder; a blow upon the upper part of the humerus, when the arm is extended; or the forcible and violent upraising of the hand or elbow, by which the head of the bone is pressed against the under part of the capsular ligament. It has also been caused by the violent contraction of the deltoid, as in raising a heavy body; for while the deltoid raises the arm, the capsular ligament is made the fulcrum; and if this gives way, dislocation downwards may be produced.

Symptoms.—The natural roundness of the shoulder is lost, owing to the head of the bone no longer supporting the deltoid muscle; the acromion process is unusually large and prominent; and a very striking symptom, which cannot fail to be perceptible on examination, is a vacuity under the acromion. There is also a want of that depression or hollow at the insertion of the deltoid, which is very conspicuous when there is no dislocation. The fibres of the deltoid, instead of giving the roundness to the shoulder, and going in a convex direction over the head of the humerus, in their way from their origins to their insertion into the deltoid eminence, go in a straight direction; and if they be felt through the integuments, it will be found that they are not only flat, but also exceedingly tense,—a condition which, as will afterwards appear, offers one of the obstacles to reduction. The rationale of these symptoms will be easily understood, when it is remembered that the head of the bone, instead of resting, as it naturally does, in the glenoid cavity, is sent down into the axilla, and consequently the distance between the insertion and the origins of the deltoid is greater than natural, and its fibres are therefore put violently on the stretch.

Fig. 93.



All the above-mentioned symptoms are observable about the upper and outer portion of the shoulder. On the opposite aspect of the joint, namely, in the axilla, there is an unnatural tumour caused by the head of the bone, which is rendered more perceptible by effecting abduction of the elbow. The surgeon may not be very sensible of this symptom while the patient holds his elbow as near as he can to his side; but the moment the elbow is pressed outwards, the head of the bone sinks in the axilla, and can be very distinctly felt. Elongation of the affected arm is particularly well marked; for ascertaining which, take the apex of the acromion and the outer condyle of the humerus, as two fixed points for measurement. The fore-arm is at a right angle with the arm; and the elbow, the situation of which should be particularly observed, as it serves for a diagnostic symptom in distinguishing the different dislocations of the shoulder from each other, is neither directed backwards nor forwards, but is in a line with the long axis of the body, and removed from the side. The patient cannot, by a voluntary effort of the muscles of the affected arm, bring the elbow to the side; and if the surgeon forcibly press it inwards, the patient complains of great pain from the head of the bone being pressed against the nerves of the axilla, and when left to itself the arm hangs away from the trunk. The patient has an inclination to support the elbow by the hand, when standing; and when sitting, to rest it on the knees. A very striking symptom is an alteration in the direction of the long axis of the humerus. In the natural state of the parts, when the arm is by the side, the axis of the humerus is parallel to the side, and the arm seems to come down from the glenoid cavity; whereas in this dislocation, the axis is placed obliquely in regard to the side, and the humerus seems to come out from the trunk instead of from the glenoid cavity. The patient has lost the power of performing the ordinary movements of the joint; and not only is he unable, by voluntary effort, to raise his arm, but it is also, in a great measure, immovable by the surgeon, especially upwards and downwards, remaining stiff in its unnatural position; and the patient, when he wishes to alter its situation, moves the whole trunk and extremity in mass. Sometimes the surgeon can move it slightly backwards and forwards, while in other directions, motion is difficult and attended with great suffering. It is proper, however, to add, that in very old persons, or in relaxed, feeble habits of the body, the immobility of the arm to the surgeon may not be so perceptible. In addition to the above symptoms, there is often tingling at the points of the fingers, with numbness of the whole limb, and œdematous swelling arising from the compression of the axillary plexus and interruption of the circulation. On moving the limb, a slight crepitus is sometimes perceived, but on continuing the motion, it ceases to be perceptible. The crepitus is, probably, owing to the effusion of serum, and the escape of synovia into the cellular tissue. This soft crepitus is easily distinguished from the hard crepitus of fracture, which, however, has been sometimes met with in dislocation of the shoulder, and is believed to depend on one or more of the tendinous attachments of the muscles having, during their disruption, torn away a portion of their osseous attachments. Many of these appearances, although very distinctly marked at first, frequently become obscured for a time by extravasation of blood and inflammatory swelling, which often supervene; but when these symptoms subside, they again become distinct and decisive.

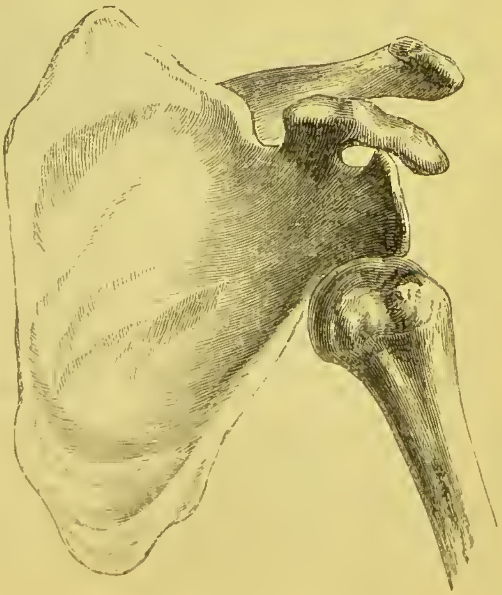
State of parts.—For conveying to the reader an idea of the state of the parts, I shall give the result of two dissections by Sir Astley Cooper, one by Sir Philip Crampton, and one by myself. Sir Astley Cooper says,—"I have dissected two recent cases of this dislocation. A sailor fell from the yard-arm on the ship's deck, injured his skull, and dislocated the arm into the axilla: he was brought into St. Thomas's Hospital, and expired immediately after he was put to bed. On the following day I obtained permission to examine his shoulder, which I removed from the body for the purpose of obtaining a more minute examination, and the following were the appearances which I found: On removing the integuments, a quantity of extravasated blood presented itself in the cellular membrane, lying immediately under the skin, and in that which covers the axillary plexus of nerves, as well as in the interstices of the muscles, extending as far as the cervix of the humerus, below the insertion of the subscapularis muscle. The axillary artery and plexus of nerves were thrown out of their course by the dislocated head of the bone, which was pushed backwards upon the subscapularis muscle. The deltoid muscle was sunken with the head of the bone; the supra- and infra-spinati were stretched over the glenoid cavity and inferior costa of the scapula. The teres major and minor had undergone but little change of position; but the latter, near its insertion, was surrounded by extravasated blood. The coraco-brachialis was uninjured. In a space between the axillary plexus and the coraco-brachialis, the dislocated head of the bone, covered by its smooth articular cartilage, and by a thin layer of cellular membrane, appeared. The capsular ligament was torn on the whole length of the inner side of the glenoid cavity, and would have admitted a much larger body than the head of the os humeri through the opening. The tendon of the subscapularis muscle, which covers the ligament, was also extensively torn. The opening of the ligament, through which the tendon of the long head of the biceps passed, was rendered larger by laceration, but the tendon itself was not torn. The head of the os humeri was thrown on the inferior costa of the scapula, between it and the ribs, and the axis of its new situation was about an inch and a half below that of the glenoid cavity from which it had been thrown."

The second case which Sir Astley Cooper had an opportunity of examining, was one in which the dislocation had existed for five weeks, and Sir Astley believed that the poor woman died from the violence used in the unsuccessful efforts to accomplish reduction by extension. Sir Astley says,—"The capsular ligament had given way in the axilla between the teres minor and subscapularis muscles; the tendon of the subscapularis was torn through at its insertion into the lesser tubercle of the os humeri, and the head of the bone rested upon the axillary plexus of nerves, and the artery. Having determined these points by dissection, I next endeavoured to reduce the bone, but finding the resistance too great to be overcome by my own efforts, I became very anxious to ascertain its origin. I therefore divided one muscle after another, cutting through the coraco-brachialis, teres major and minor, and infra-spinatus muscles; yet still the opposition to my efforts remained, and with but little apparent change. I then conceived that the deltoid must be the chief cause of my failure, and by elevating the arm I relaxed this muscle, but still could not reduce the dislocation. I next divided the deltoid muscle, and then found the supra-spinatus muscle my great opponent, until I drew the arm directly upwards, when the head of the bone glided into the glenoid cavity. The deltoid and supra-spinatus muscles are those which most powerfully resist reduction in this accident."

Sir Philip Crampton records an examination which he made by dissection, of a recent dislocation downwards in a labouring man, who was brought to the Dublin Infirmary in 1808, in a dying state, owing to injuries received by the fall of a wall. The dislocation was of the right shoulder, and death took place in about two hours. The head of the humerus was lodged on the neck of the scapula and upper part of the inferior costa, and surrounded by cellular tissue extremely ecchymosed. The head of the bone had pressed down the teres minor, and in its descent had passed through the subscapularis muscle, the fibres of which embraced the neck of the bone. The fibres of the subscapularis were also partly torn up from the scapula. The triceps crossed the neck of the humerus on its dorsal side, and the coraco-brachialis and short head of the biceps described a curve on its sternal side. The tendon of the long head of the biceps remained in its groove, but its sheath was partially lacerated. The tendons of the supra- and infra-spinati, and of the teres minor were completely torn off from the humerus, and along with them the surface of the greater tubercle. The capsular ligament was torn from the lower part of the neck of the humerus to the extent of half its circumference, and the axillary vessels and nerves were made to describe a curve backwards, by the presence of the head of the bone which was in contact with them.

When I taught anatomy in this University, a body, apparently that of a labouring man, was brought to the dissecting room, which presented all the appearances of a dislocation downwards of the shoulder. I made a careful dissection of all the parts, and the preparation is still in my possession. The dislocation must have been of very long standing, as the glenoid cavity was a good deal filled up, and a new shallow cavity formed on the neck and upper part of the inferior costa of the scapula for the head of the humerus, which had lost its cartilage, and was covered over with porcellanous deposit. The cellular tissue was thickened about the ball, to form a

Fig. 94.

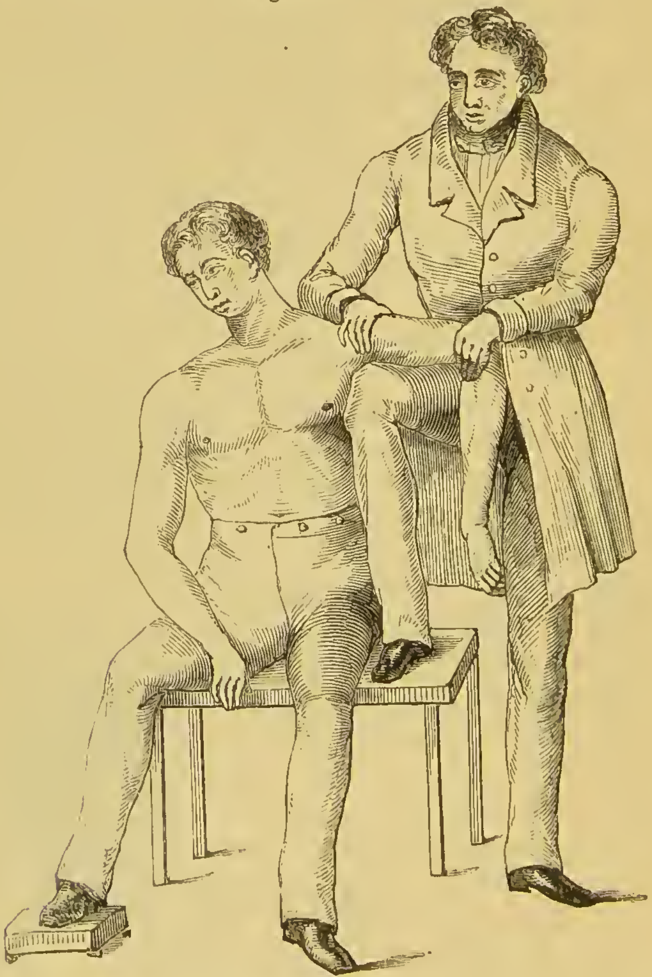


capsular ligament; and the precise position into which the head of the humerus was pushed, in escaping from its socket through the under part of the capsular ligament, was behind the subscapularis, in front of the teres minor and long head of the triceps and upon the teres major and latissimus dorsi muscles, with the axillary vessels and nerves to its inferior and inner aspect. As the body was brought to the dissecting room at the period when subjects were procured by exhumation, I found it impossible to procure a history of the case.

Treatment.—Various methods are employed for accomplishing reduction.

By the Knee in the Axilla.—If the dislocation be recent, and in a thin, attenuated subject, let the patient be seated on a low chair, and let the surgeon, placing himself beside him with his foot resting upon the chair, put his knee into the axilla, and while with one hand he presses upon the acromion, with the other let him depress the elbow, thus making his knee a fulcrum, and the humerus of the patient a lever. I have often reduced dislocations by this method with the greatest ease.

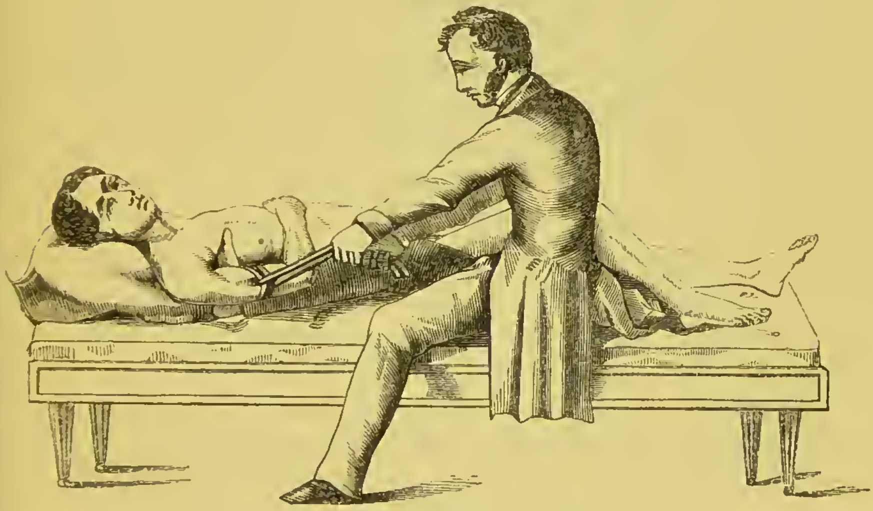
Fig. 95.



By the Heel in the Axilla.—This is a mode which has been very strongly recommended by Sir Astley Cooper, and is often attended with success. The patient is placed in the recumbent posture on a couch, and the surgeon having applied a wetted roller round the lower part of the arm, and having tied a handkerchief or towel round the arm above the wetted roller, places himself on the same seat with one foot resting on the floor, and the heel of the other in the axilla, and then extends the arm by pulling the towel or handkerchief.

In this method of reduction there are various ways of applying the extending force. One is that just described; another is to apply the handkerchief to the wrist; a third is for the surgeon, having put a skein of worsted round the arm, to pass his head through the double of the worsted, and make it rest on the back of his neck, and while pulling the arm to raise up and draw back his own body, by which means he will be able to exert a much greater extending force than by either of the two former ways; and a fourth plan, which may be adopted in cases of considerable difficulty, is to make the assistants give additional extending force by pulling the ends of the handkerchief or towel fixed round the arm. It has been remarked that a great advantage of this method of reduction is, that the surgeon, both at the long end of the lever and at the fulcrum, can with his sense of touch appreciate the effect produced by the force, and is able, therefore, at once to modify its application as circumstances may require; and as soon as the heel detects the slightest change in the position of the bone, he can immediately direct the humerus towards the glenoid cavity.

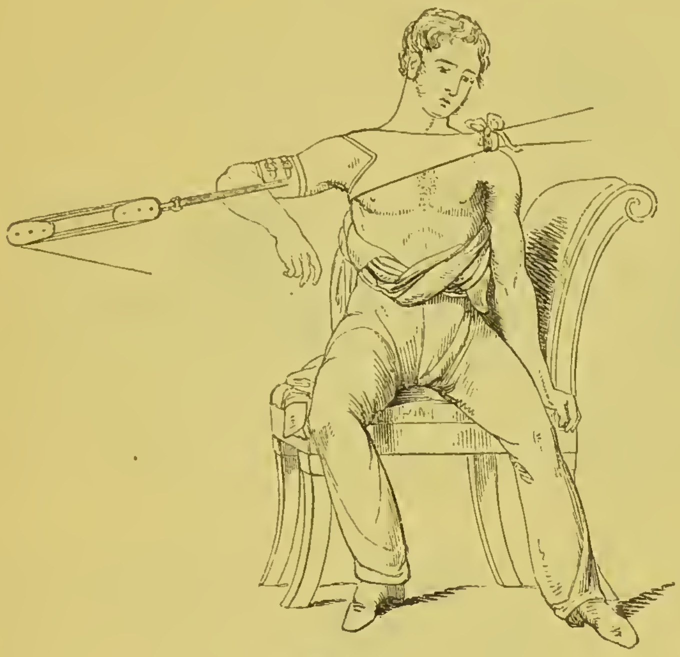
Fig. 96.



By Manual Extension.—The patient being placed in a chair, the first object is, to fix the scapula so as to afford the necessary counter-extension. This may be done by applying the double of a sheet under the axilla, carrying it over the opposite shoulder, and fixing it to some post or resisting object on the opposite side of the patient to that on which the injury is situated. If the sheet be not very much pressed up to the axilla, and its extremities be raised so as to be on a level with the opposite shoulder, it will fix only the body and under angle of the scapula, and leave the parts near the glenoid cavity to be drawn from the chest by the extending force applied to the arm. The more elegant method of affording counter-extension is by a well-padded ring of leather, having attached to it two belts, by which it may be fastened to a post or any resisting object; and the trunk and scapula being thus fixed, the necessary counter-extension is obtained. The next object is to employ extension; and, for this purpose, a few turns of a wetted roller should be applied to the arm above the elbow, and a band of worsted, or a piece of linen, fastened upon it by the clove-hitch knot; for this knot, while tight enough to prevent slipping, cannot become so tight as to produce dangerous compression. The arm should be elevated to the horizontal position, to relax the deltoid and supra-spinatus muscles; and extension should be afforded by assistants drawing the ends of the worsted, or towel, or linen, gradually, slowly, and steadily; and after the extension has been kept up for several minutes, and while it is still so, the surgeon, placing his foot upon the chair in which the patient sits, should put his knee into the axilla, and with one hand press the acromion downwards and inwards, and with the other slightly press down the elbow, pushing the head of the bone upwards by means of the knee, which can be done by raising the foot so as to rest it on the toes. During the whole time the surgeon, before the introduction of chloroform, used to divert the patient's attention by engaging him in conversation; but with such an invaluable auxiliary, that practice is no longer needful.

By means of Pulleys.—If it be probable, from the muscular strength of the patient, or from the time that has elapsed since the occurrence of the dislocation, that very considerable extension will be required, it is advisable to afford it by means of pulleys. Previously to their use, the surgeon will diminish the degree of resistance to be overcome, by bringing the patient fully under the influence of chloroform. The necessary counter-extension can be very conveniently afforded by the plan recommended in the description of the former method of reduction. The extending force may be applied to the lower part of the arm, by placing round it a few turns of a wetted roller, over which a belt of leather is fastened, with two straps extending from it, at the extremity of each of which is a ring, to which the hook at one end of the pulleys is fixed, while the hook attached to the other set of pulleys is affixed to a ring in some resisting object, care being taken that the ring is on a level with the line of counter-extension. Extension is then produced by pulling the cord of the pulleys. This method is useful for allowing the application of considerable extending force, which, however, might be afforded in the ordinary way, by increasing the number of assistants; but the principal advantage of the pulleys is, that by them the force can be applied steadily and gradually; whereas, when extension has to be long kept up by the usual method, the assistants become wearied, and the extension is unequal and accompanied with sudden jerks. The pulleys so greatly increase the force, that few assistants are required. The proper method of applying extension by the pulleys, is to draw the cord slowly and steadily, until the extension becomes considerable, to keep up the same degree of extension for several minutes, and then to increase it again gently. When considerable extension has been employed, the surgeon should, by placing his knee in the axilla, with one hand on the acromion, and the other on the lower part of the arm, endeavour to replace the head of the bone in the manner described in the last section. In this method the surgeon, although sensible of the return of the bone into its natural situation, seldom finds it return with a snap, as when reduction is accomplished by the other methods.

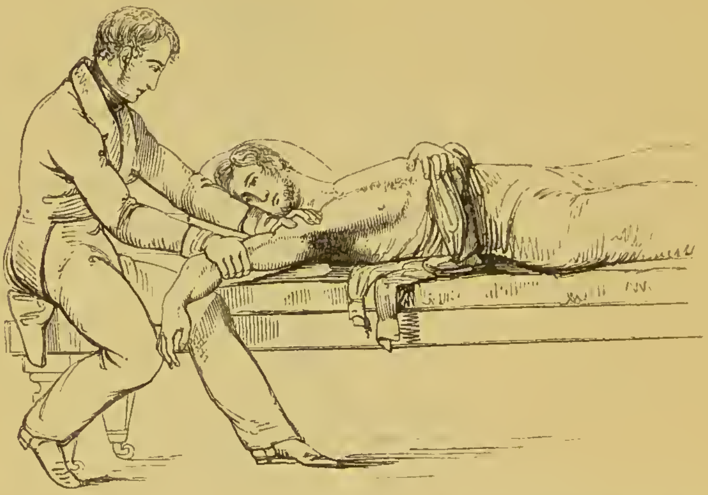
Fig. 97.



From Cooper.

"There is yet another mode of effecting the reduction of these dislocations, which I will mention, in order to render this part of the subject complete. It is a mode which was invented by Mr. White, of Manchester, about the middle of the last century, and which has been revived latterly by M. Malgaigne in France. It consists in raising the arm perpendicularly by the side of the head; by which means the supra-spinatus muscle, which Sir Astley Cooper has shown to be the principal antagonist to the reduction, is completely relaxed, and the head of the humerus is drawn directly upwards into its cavity. This has sometimes been effected by means of a set of pulleys affixed to the ceiling, by which the arm is raised perpendicularly, whilst the scapula is fixed by a towel or girth properly applied to the shoulder, and secured to the floor. But a more simple method, and one that will answer every purpose, if the muscles are tolerably relaxed, is that which is represented in the cut; the surgeon sitting behind the patient, elevating the arm with one hand, and with the other fixing the scapula, which is also to be further secured by a round towel passing from the shoulder to the foot of the bed."

Fig. 98.



II. COMPLETE DISLOCATION FORWARDS.

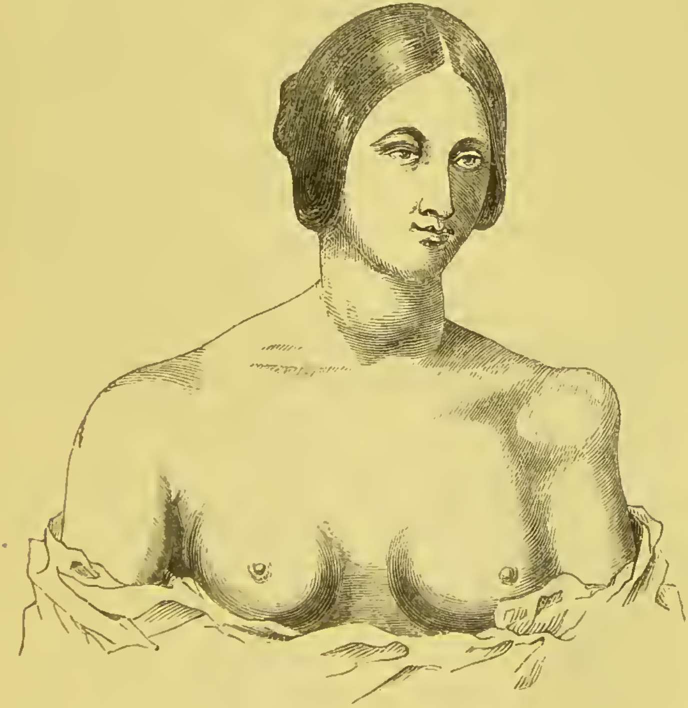
Symptoms.—In this dislocation, there is the absence of the natural roundness of the shoulder, the acromion more pointed, and the vacuity greater than in the former dislocation. There is an unnatural flattening of the shoulder behind, and an unnatural tumour, caused by the head of the bone, below and to the sternal side of the coracoid process, and below the middle of the clavicle. The elbow is removed from the trunk, and drawn a little backwards; and the long axis of the humerus, instead of being parallel with the trunk, and directed upwards to the glenoid cavity, inclines towards the trunk, and extends upwards to a point underneath the middle of the clavicle. The forearm is at a right angle with the arm. The pain is less than in the former dislocation, but the motions of the joint are much more restrained: for any movement of the arm backwards is prevented by the resistance of muscles, movement outwards by the clavicle opposing the head of the bone, and motion forwards by the head of the bone striking the coracoid process.

With regard to another symptom, namely, whether the arm be shortened or lengthened, surgical authorities are divided. According to Sir Astley Cooper, the arm will be somewhat shortened, but he does not, in any of the cases recorded in his work, mention the state of this symptom, although it must no doubt have been from what he observed in those cases, that he arrived at the above conclusion. In a very interesting case recorded by Sir Philip Crampton,—a case well worthy of attention, inasmuch as it settles another disputed point, which will presently be mentioned,—the axis of the head of the bone was nearly a quarter of an inch higher than that of the glenoid cavity : the arm, therefore, must have been shorter than natural.

On the other hand, Desault and Malgaigne maintained that there would be elongation ; and Dupuytren, although at one time of opinion that the arm could be elongated only in dislocation downwards, afterwards agreed with Desault and Malgaigne, and stated, that after dissecting the ligaments in a recent joint, and producing dislocation, he found the arm had lengthened as much as half an inch.

There is a point, concerning which, for a considerable time, there existed much difference of opinion, namely, whether complete dislocation forwards be a primary or consecutive dislocation, — that is, whether the bone can be sent out at once by violence from the glenoid cavity to the situation which it occupies in this dislocation ; or whether it be first dislocated downwards, and suffer a secondary displacement upwards, by the muscles drawing it upwards and inwards,

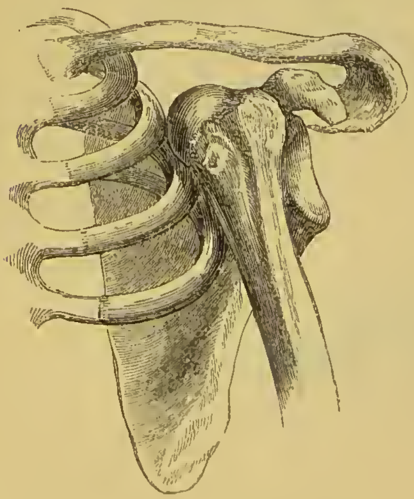
Fig. 99.



as far as the clavicle will allow. Some have gone so far as to say, that the head of the bone cannot get into the position it occupies in this dislocation, except by suffering a secondary displacement, after having first been forced downwards. Others, for example, Desault, Petit, Dupuytren in France, and the late Mr. Hey and Professor S. Cooper in this country, did not deny the possibility of its being primary, but they believed, as will be seen by a perusal of their writings, that it is, in fact, very seldom primary, and almost always consecutive to dislocation downwards. It is very evident that Sir Astley Cooper considered this a primary dislocation. The case recorded by Sir Philip Crampton, which will be described in mentioning the state of the parts, very clearly proves that, in some cases at least, this dislocation is primary.

State of the parts.—In the third volume of the "Dublin Journal of Medical Science," there is a case of undoubted primary dislocation recorded by Sir Philip Crampton, which is interesting, not only as setting at rest the long-disputed question above mentioned, but also as being the first recorded dissection of the parts in an example of recent dislocation forwards. The head of the humerus was lodged on the inner side of the neck of the scapula, to the sternal side of the root of the coracoid process, and extending up nearly as far as the notch in the superior costa. The capsular ligament was perfectly entire in the direction of the axilla, showing that the bone could not have been sent first to the axilla, and afterwards to the situation here described. The opening in the capsular ligament was on its inner side, and was caused by its being torn from the glenoid cavity, the rent extending from the supra-spinatus muscle above, to the under part of the subscapularis muscle below. The supra- and infra-spinati were much on the stretch, but not lacerated, and the subscapularis muscle was partly detached from the upper and the anterior parts of the subscapular fossa, and pressed downwards, so that its fibres in a curved manner embraced the neck of the bone. The axis of the head of the bone was scarcely a quarter of an inch above the centre of the glenoid cavity, and the vessels and nerves were on the sternal side of the humerus. Mr. Key made a dissection of a shoulder which had long been dislocated inwards. The glenoid cavity was completely filled up by ligamentous matter, and the head of the

Fig. 100.



humerus was situated under the clavicle to the sternal side of the root of the coracoid process, in contact with the venter of the scapula, from which the subscapularis muscle was at that part torn off, and separated from the ribs by that muscle and the serratus magnus muscle. A new socket and complete capsular ligament had been formed. Mr. Curling made a dissection of a dislocation forwards, and found the capsular ligament completely torn away from the neck of the humerus, the infra-spinatus and subscapularis muscles torn away from the tuberosities of the humerus, and the head of the bone pressed against the axillary vessels and nerves.

I believe that in complete dislocation forwards, the head of the bone will generally be in the position described above, with the pectoral muscles before it, the second and third ribs behind it, and the clavicle above it.

Treatment.—The reduction is to be effected by the means recommended in describing the methods by manual extension, and by pulleys, in the former dislocation, with the two following peculiarities :—First, that the extension should be made downwards and outwards, in the line of the unnatural direction of the axis of the humerus, until the head of the bone be below the coracoid process; then the extension should be continued with the arm raised to the horizontal position. Second, that after extension has been applied for a considerable time, and while it is still being continued, the surgeon should endeavour to replace the head of the bone, by employing the humerus as a lever, pressing the lower part of it forwards, and its head backwards in the direction of the glenoid cavity; and while doing so, he should also rotate the arm. This can be most effectually done by using the fore-arm as a lever, having it bent at a right angle with the arm, in order to prevent stretching of the biceps, which would be an obstacle to reduction.

In attempting replacement in this, as in every other dislocation, the extension and counter-extension must always be in a line with each other.

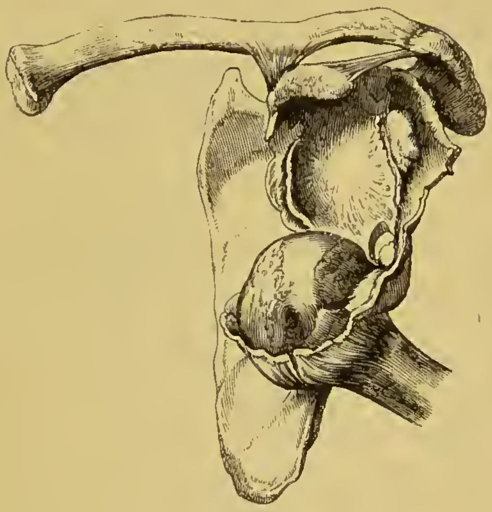
III. PARTIAL DISLOCATION FORWARDS.

The partial dislocation forwards of Sir Astley Cooper is no doubt the injury described by Boyer as dislocation inwards, by Velpeau as subpectoral dislocation, and by Malgaigne as subcoracoid luxation. Although the name given by Sir A. Cooper is retained, the dislocation cannot be said to be partial.

Symptoms.—The head of the bone is drawn forwards underneath the coracoid process, where there is an unnatural tumour, whilst there is a depression opposite the back part of the shoulder joint. The posterior half of the glenoid cavity is perceptible to the fingers, whilst the long axis of the humerus is in front and in a line with the coracoid process. The elbow is slightly removed from the side, and is in a line behind the long axis of the body. The arm can partially perform such movements as do not require its elevation, but it cannot be raised.

State of the parts.—The head of the bone is under the coracoid process, and rests against it, the edge of the glenoid cavity, and the anterior part of the neck of the scapula, where, in an unreduced dislocation, a new cavity has been found formed for its reception. The last edition of Sir Astley Cooper's work on "Fractures and Dislocations" contains the accompanying delineation of the state of parts in an unreduced dislocation found in the dead body. It seems possible for this dislocation to occur without the capsular ligament being torn through; but in dissecting an old dislocation, it was found that the ligament had been ruptured and become attached to the coracoid process. The latissimus dorsi and two teres muscles are put upon the stretch, and the pectoralis major, except some of its inferior fibres, is relaxed. The spinati muscles are slightly on the stretch, and the posterior fibres of the deltoid are extended, while the anterior are relaxed.

Fig. 101.



Treatment.—Reduction is accomplished in the same manner as in the preceding injury, namely, by counter-extension, extension, and a lever-like motion of the humerus; less force, however, is required.

IV. DISLOCATION BACKWARDS.

Dislocation of the head of the humerus on the dorsum of the scapula is so rare an accident, that Desault had never seen an instance of it; Boyer met with it but once in the living body; only two cases occurred at Guy's Hospital in thirty-eight years; in the same number of years Sir Astley Cooper met with two cases, and not more than four cases occurred in his practice during his whole professional career; and Mr. Lawrence, in his lectures, delivered at St. Bartholomew's Hospital in 1830, states that at that time he had never seen the humerus dislocated backwards. Two cases are reported from the Middlesex Hospital; one from the North London Hospital; Mr. Toulmin, of Hackney, met with a case; Mr. C. M.

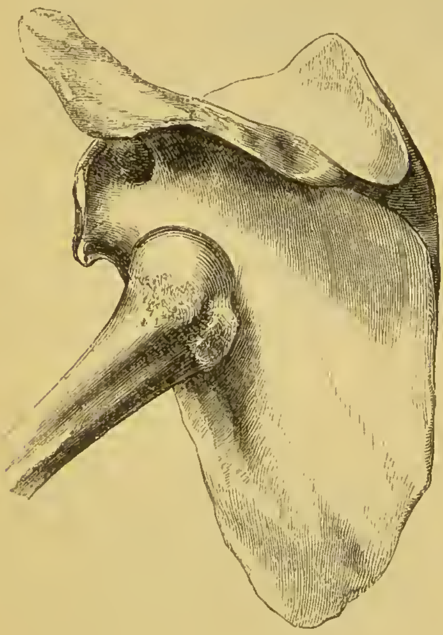
Coley, of Bridgeworth, with two ; I have met with two examples ; and there are on record several other cases, to the particulars of which I may have occasion to refer.

Causes.— In one of the cases seen by Sir Astley Cooper, the injury was produced by pushing a person violently with the arm elevated. Of the two cases which occurred at Middlesex Hospital, the one was caused by a heavy box from the top of a bedstead falling on the hand of the person while the arm was elevated ; the other, in a woman ninety-four years of age, was occasioned by a fall on the front of the shoulder, in consequence of having trodden on some orange-peel. Mr. Toulmin's case was in an unusually muscular gentleman, and was caused by a fall from his horse. Of the cases narrated by Mr. Coley, of Bridgeworth, one was caused by the man being pulled down by a calf which he was driving, a cord which he held fast in his hand being tied to one of the animal's legs ; the other by the person being dashed from his horse against a tree, the shock being received on the front of the shoulder. In a case of this dislocation, of long standing, in which Mr. Key had an opportunity of making a minute examination of the state of the parts after death, the injury was caused by spasmodic contraction of the muscles during an epileptic fit. The exciting causes of the other cases recorded are not mentioned.

Symptoms.—The injury is characterized by the absence of the natural roundness of the shoulder, unnatural prominence of the acromion process, with depression under it ; unnatural flatness of the anterior part of the shoulder, together with a stretched appearance of the skin at that part, and an unnatural tumour on the dorsum of the scapula underneath the spine, caused by the head of the humerus, which can be very distinctly felt. As to the precise direction of the long axis of the arm and the position of the elbow, surgeons are at variance. In the cases mentioned by Mr. Coley and Mr. Toulmin, the elbow was forward and close to the side. In one of the cases admitted into Middlesex Hospital, the arm was close to the side, and in a line with the long axis of the body. In the other recorded cases, the precise position of the elbow is not stated. In one of the cases which I had an opportunity of seeing, the elbow was directed forwards ; in the other, it was merely removed from the side of the body. The long axis of the humerus is of course directed to the dorsum of the scapula, and the position of the arm and elbow, as might be expected, from considering what muscles would thus be put upon the stretch, is for the long axis of the arm to extend downwards and forwards, with the elbow removed from the side, and in a line before the long axis of the body. Some surgical authorities give this direction of the long axis of the arm, and this position of the elbow, as symptoms, without stating whether they do so from reasoning on the unnatural condition of the muscles, or from observation. It is not more difficult to explain an occasional deviation from this attitude in this dislocation, than it is to explain how in some very rare instances the elbow is nearly close to the side in dislocation downwards, although in by far the greater number of examples it is removed from the side to diminish the painful tension of the deltoid muscle.

State of the parts.—The head of the bone lies on the dorsum of the scapula, the capsular ligament is ruptured, the muscles in front of the joint are stretched, and the infra-spinatus and terres minor are torn up from the scapula, before the head of the bone can arrive at its unusual situation. In the case in which the injury was caused by spasmodic contraction of the muscles in an epileptic fit, and of which a dissection was made by Mr. Key; the gentleman lived for seven years after the accident, but the dislocation could not be kept reduced, and he never resumed the use of his arm. On inspection after death, it was found by Mr. Key, that the explanation of the impossibility of keeping it reduced, was laceration of the tendon of the subscapularis muscle, and its adhesion to the edge of the glenoid cavity with very imperfect union. The anterior part of the capsular ligament was torn at the insertion of the subscapularis, and the posterior part was carried back with the bone, which, instead of resting far back on the dorsum of the scapula, rested on the posterior edge of the articular surface, and on the inferior costa close to the articulation.

Fig. 102.



Treatment.—In two of the recorded cases of this injury, Sir Astley Cooper accomplished reduction by raising the hand and arm, and turning the hand backwards behind the head. In another instance, this method was tried without success, and the bone was replaced by extension of the arm, the scapula being fixed by placing the heel in the axilla. In another, reduction was effected by extension from the wrist in the direction of the displaced bone without the heel in the axilla; and in the remaining cases, with the exception of one which remained unreduced, the bone seems to have been replaced by extension and counter-extension, and in some of them with very little difficulty.

The general principles already mentioned as applicable to reduction of dislocation downwards, in the description of the methods by manual extension and by pulleys, are applicable to this luxation; but the extension should be made forwards and outwards, with the arm raised to a horizontal position; and while the extension and counter-extension are being applied, the surgeon should endeavour to direct the head of the bone upwards and forwards by employing the humerus as a lever, pressing the knee against the upper and back part of the humerus, and drawing the elbow a little backwards.

V. PARTIAL DISLOCATION UPWARDS.

This is an accident so extremely rare, that it is not mentioned by many surgical authorities. The possibility of its occurrence is proved by a case which came under the observation of Mr. Soden, jun., of Bath, and also by a preparation, to which reference will be found in another page. An account of the case referred to was drawn up by Mr. Soden, and read before the Royal Medical and Chirurgical Society of London, and published in their Transactions for the year 1841. A description of the case will also be found with an engraving in Sir Astley Cooper's work on "Fractures and Dislocations," edited by Mr. Bransby B. Cooper. The following are some of the particulars:—Joseph Cooper died in Bath, in November, 1839, in consequence of a compound fracture of the skull, and his death afforded an opportunity of examining an old injury of the right shoulder, caused by receiving the whole weight of his body on his elbow in falling backwards. After the subsidence of the inflammatory symptoms which supervened, a difference was perceived between the two shoulders. When the man stood erect with his arms dependent, the bone appeared to be drawn too much up in the glenoid cavity. The power of abduction was very limited, because the humerus came against the acromion process; and when the arm was moved, on placing the hand on the shoulder, a sensation of crepitus simulating fracture was experienced, which, however, was merely the rubbing of the humerus on the acromion process. The head of the humerus appeared unnaturally prominent in front; the man could move his arm backwards and forwards, but was unable to raise the smallest weight; and any exertion or motion which could excite the action of the biceps, caused severe pain, and could not, therefore, be performed. The capsular ligament was but slightly ruptured, but the tendon of the biceps was dislocated from its groove, and placed on the lesser tubercle of the humerus,—a position which accounted for the pain experienced when any force was used which called the biceps muscles into action. The head of the humerus was sent upwards, and where it was in contact with the acromion process, ulceration had commenced on the head of the humerus. This case shows how greatly the tendon of the biceps contributes to the strength of the joint, and how useful it is when in its proper situation, for preventing dislocation upwards.

In the museum of the Medico-Chirurgical Society of Aberdeen, there is a preparation of an unreduced partial dislocation upwards, which in all respects very closely agrees with the description and figure of the above case. It was taken from the body of a subject brought to one of the dissecting-rooms in Aberdeen.

DISLOCATION OF THE ELBOW JOINT.

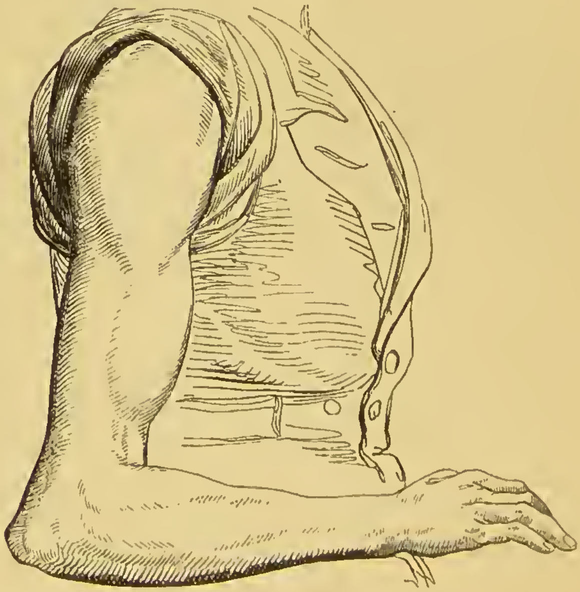
This articulation is liable to six dislocations, of which three include both bones of the fore-arm, and three are dislocations of single bones.

They are named thus—Dislocation of both bones backwards; Dislocation of both bones inwards; Dislocation of both bones outwards; Dislocation of the ulna backwards; Dislocation of the radius backwards; and, Dislocation of the radius forwards.

I. DISLOCATION OF BOTH BONES BACKWARDS.

This is the most frequent of the dislocations at the elbow, and is caused sometimes by a wrench, but more generally by a fall on the hand, when the fore-arm is not perfectly extended. Under such circumstances the radius and ulna come suddenly to a state of rest,

Fig. 103.



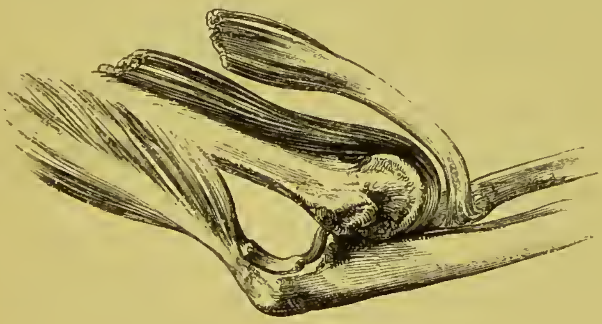
From Liston.

and the humerus by the weight of the body is thrown forwards on them.

Symptoms.—There is an unnatural prominence behind the joint, caused by the extremities of both bones, but more especially of the ulna, and an unnatural hard swelling in front of the elbow produced by the extremity of the humerus. The anterior aspect of the fore-arm is preternaturally shortened. In some cases, the fore-arm is at a right-angle with the arm, while in others it is midway between extension and semiflexion. The hand is between pronation and supination, but more inclined to the latter. The motions of flexion and extension, as well as those of pronation and supination, are suspended, or at all events very difficult, limited, and painful; but an unnatural lateral motion can be produced. The accompanying figure from Liston represents an unreduced dislocation of seven years' standing, in which case the movements of the hand were considerably regained.

State of the parts.—The coronoid process of the ulna occupies the olecranon fossa, the head of the radius is lodged behind the external condyle, and the lower end of the humerus rests on the anterior surface of the radius and ulna. All the four ligaments are ruptured, though some of the fibres of the internal lateral are preserved. The triceps muscle is much relaxed from the approximation of its points of attachment; the brachialis anticus and the biceps are either very much put upon the stretch or lacerated, and the former has been found occasionally to tear away a portion of its osseous attachment to the coronoid process. All the muscles originating from either condyle of the humerus, except the supinator radii brevis, are in a state of relaxation.

Fig. 104.



From Cooper.

Treatment.—Sir Astley Cooper recommends the surgeon, having seated his patient on a low chair, to place his knee in front of the elbow joint, against the front of the radius and ulna, and after having for some time attempted, by pressing backwards with his knee, to dislodge the coronoid process from the olecranon fossa, then forcibly but slowly to attempt flexion of the fore-arm, when reduction will be soon accomplished. The object of pressing with the knee is, as already stated, to displace the coronoid process from the olecranon fossa; and the object of the forcible flexion is to bring the bones forward to their natural position. Boyer effected reduction in another manner. In accordance with his mode, an assistant is to take hold of the middle of the humerus, and thus afford the necessary counter-extension, and another assistant to make extension at the wrist, keeping the fore-arm at a right angle with the arm, while the surgeon grasps the elbow with both hands, having his fingers in front of the humerus, and his thumbs on the olecranon process, against which he directs pressure downwards and forwards. According to Sir Astley Cooper's method, the surgeon endeavours to displace the coronoid process from the olecranon fossa, by pressing the knee against the front of the fore-arm; in Boyer's, by pressing with the thumbs the olecranon process downwards and forwards. In the former plan the bones are brought forward by flexion of the fore-arm; in the latter, by an assistant pulling at the wrist.

I have, with great ease and readiness, effected reduction by employing two assistants,—one for fixing the humerus, the other for effecting extension, which can be best done by grasping the middle of the fore-arm with both hands, and pulling forwards—and while extension and counter-extension are being used, by placing the fingers of one hand in front of the fore-arm, as near as possible to the elbow, and the other upon the olecranon process, and pulling forcibly with both hands, as if the object were to draw the heads of both bones of the fore-arm away from the humerus. By this means the coronoid process is very speedily dislodged from the olecranon fossa, and the extension then brings the bones forwards to their natural situation. The advantage of affording extension, by grasping with both hands the middle of the fore-arm is, that the force thus acts as much on the ulna as on the radius; whereas, if extension be applied at the wrist, the force is in a great measure lost; for the ulna, which offers the chief obstacle to reduction, being small near the wrist, and having little connexion with that articulation, is acted upon only indirectly through the medium of the structures by which it is connected with the radius. According to Mr. Liston, reduction is thus accomplished:—"The arm and fore-arm are extended, and the limb is brought well behind the trunk, so as to relax the triceps; the surgeon performs extension and counter-extension, pulling the fore-arm with one hand, whilst he pushes with the other placed on the scapula. If the force thus employed prove insufficient, as it seldom will in recent cases, the patient may be placed on his face on a couch, and on the limb being brought into the favourable position already noticed, counter-extension may be made by the heel planted against the inferior costa of the scapula, whilst the wrist is pulled with both hands."

II. AND III. DISLOCATION INWARDS, AND DISLOCATION OUTWARDS.

The radius and ulna may be dislocated laterally, that is, they may be drawn to the one side of the humerus or the other; but these dislocations are extremely rare, and never complete, on account of the great breadth of the articulating surfaces. They are readily detected by the unnatural prominence along the plane of the joint, either internally or externally, according to the nature of the dislocation, and by the inability to flex the fore-arm; and they are easily reduced by fixing the arm, pulling the fore-arm, and pressing the bone, either outwards or inwards, as the case may demand.

IV. DISLOCATION OF THE ULNA BACKWARDS.

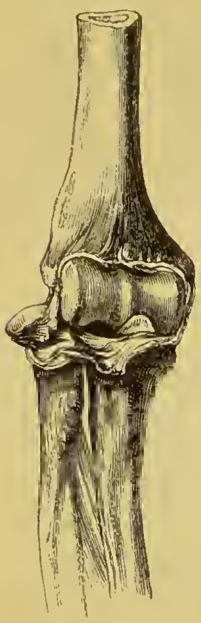
The distinguishing marks of this dislocation are, the projection of the olecranon process behind the humerus, the hand and fore-arm being twisted inwards to the ulnar aspect of the fore-arm, and the impossibility of bending the fore-arm to more than a right angle. In some instances it has been found impossible to bend it even to that extent, and any attempts to do so have caused excessive pain. In one recorded dissection of this dislocation, the coronoid process was lodged in the olecranon fossa; the coronary, oblique, and part of the interosseous ligaments were torn; the triceps muscle was much relaxed, and the brachialis muscle stretched under the humerus.

Treatment.—Press the knee against the front of the elbow-joint; then with one hand attempt to bend the fore-arm over the knee, drawing it at the same time forwards, and with the other hand the olecranon process downwards and forwards. In a case occurring in the practice of Mr. Gossett, in which the coronoid process rested on the internal condyle instead of the olecranon fossa, and the pain on bending the arm was insupportable, owing it was supposed to the pressure of the coronoid process against the ulnar nerve, reduction was accomplished by extension and counter-extension applied by two persons pulling in opposite directions, and by the pressure of the olecranon process downwards and outwards, while the fore-arm was suddenly flexed.

V. DISLOCATION OF THE RADIUS BACKWARDS.

This must be an extremely rare injury, since Boyer has met with it only twice, and Sir Astley Cooper saw it only once in the dead subject, but never in the living body. Mr. Lawrence has seen the accident, and Mr. Bransby B. Cooper gives a short description of one case complicated with fracture of the ulna, which came under his observation; but the most minute account I have seen of this dislocation is by Langenbeck, of Göttingen, who met with two examples, the one in a man twenty years of age, and the other in a child of five years.

Fig. 105.



From COOPER.

In these cases, which are published in the "Lancet," the hand was prone, and could not be brought into a state of supination; the fore-arm was moderately bent, and admitted of neither flexion nor extension; the skin was lax along the inner side of the internal condyle, and the head of the radius could be felt behind the external condyle; the articulating cavity of the head of the bone could be felt in the child, but its circumference only in the adult. In both these cases, replacement was accomplished by applying counter-extension to the arm, and extension to the fore-arm, and pressing the head of the bone inwards. Strong and long-continued extension was necessary in the one case, while very moderate extension with pressure was sufficient in the other. In this injury, extension should be made from the hand, and when it has been employed for some time, and is still being continued, it would be judicious, besides pressing the head of the bone inwards, to supinate the hand forcibly, which would assist the pressure in sending the head of the bone forwards, because in supination while the under extremity is sent outwards, the superior is directed forwards. In the example which Sir Astley Cooper met with in the dead subject, the account of the state of the parts on dissection is as follows:—The head of the radius was found behind the external condyle, the coronary and oblique ligaments were torn, and the capsular ligament—by which I suppose is meant part of the external, lateral, and anterior ligaments—had partly given way.

VI. DISLOCATION FORWARDS OF THE RADIUS.

Boyer never met with this dislocation, and says, that no authentic example exists of the bone being thrown forwards on the external condyle. Many cases, however, are recorded: Sir Astley Cooper met with six examples; Mr. Bransby B. Cooper with two; and instances have occurred in the experience of Mr. Lawrence, Mr. Tyrrel, Mr. Gosset, and many other surgeons. I have met with two examples, the one in a girl of eleven, the other in a boy of about thirteen years of age: the symptoms were nearly the same in both cases. The fore-arm was about midway between complete extension and semiflexion, the hand slightly supinated, making an angle of about forty-five degrees with the plane of complete supination; the movements in the direction of pronation and supination, as well as those of flexion and extension, were extremely limited; and on attempting to bend the fore-arm, I was particularly sensible of a sudden check to further flexion by an obstacle which left a decided impression of its being caused by one bone striking against another. There was a perceptible alteration of the direction of the long axis of the radius, which, instead of leading up to the under part of the external condyle, was directed in front of it, where the head of the radius could be distinctly felt, forming an unnatural tumour. There was an unnatural depression perceptible below the external condyle, and in one of the cases the patient complained of great pain in the upper part of the interosseous space, which pain was much aggravated by pressure. In each case, I accomplished reduction by making one assistant fix the humerus, and another effect extension from the hand, by which means the force acts on the radius alone; and when extension and counter-extension

Fig. 106.

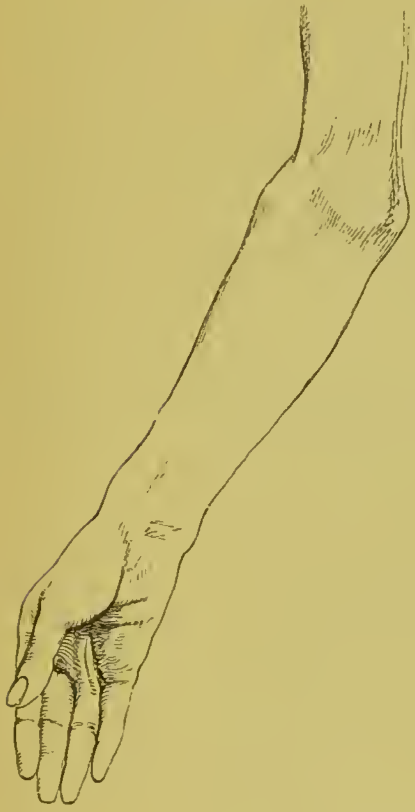
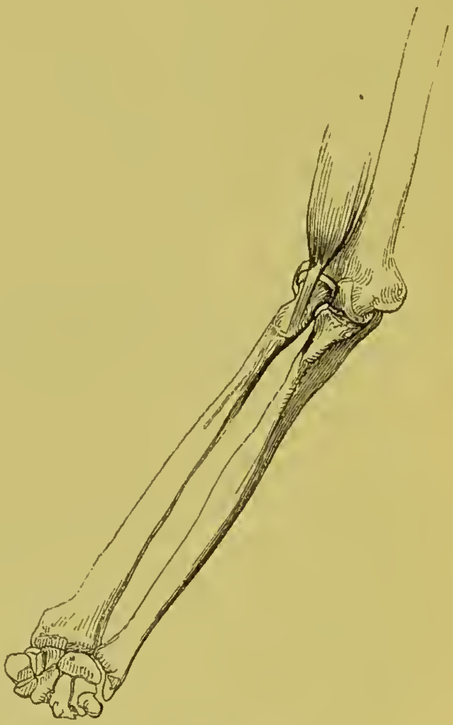
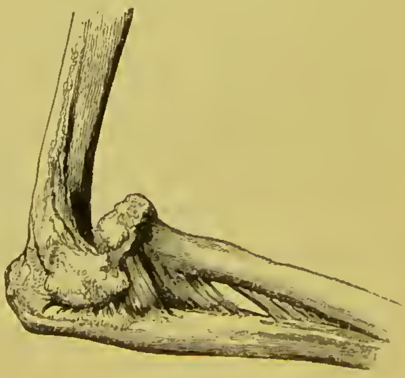


Fig. 107.



From Liston.

Fig. 108.



From Cooper.

had been employed for some time, and were still being used, with the arm as straight as it could be made, I then with the thumb of one hand forcibly pressed the head of the bone backwards, making at the same time with the other hand a forcible attempt at pronation, when the head of the bone was tilted back into its proper situation. In one of the cases, reduction was accomplished with great difficulty, in consequence of its having remained for four days unreduced, during which the case was treated as a sprain by a practitioner, who mistook the nature of the injury.

The head of the bone rests above the external condyle, and it is the resistance offered by the humerus which prevents flexion of the forearm. The external lateral, and anterior ligaments of the elbow joint are lacerated, as are also the coronary, the oblique, and part of the interosseous; otherwise the radius could not get into its unnatural situation.

The two dislocations last described are as properly accounted dislocations of the superior radio-ulnar articulation, as of the elbow joint, —both articulations being involved in the injuries.

DISLOCATIONS OF THE INFERIOR RADIO-ULNAR ARTICULATION.

These injuries, which consist of the displacement of the one bone with respect to the other at the inferior radio-ulnar articulation, are not to be confounded with dislocations of the wrist joint. The writers, who have described these rare accidents, have not all employed the same nomenclature, some making the direction of the radius, others that of the ulna, the basis of arrangement. There are only two of these dislocations. They are described by some authors as dislocation forwards and dislocation backwards of the radius; by others, as dislocation backwards and dislocation forwards of the ulna. As the two bones are driven in opposite directions, it follows, that the dislocation forwards of the radius of some authors is the dislocation backwards of the ulna of others, and that dislocation backwards of the radius of some is the dislocation forwards of the radius of others. In the following description the direction of the radius is made the basis of arrangement.

These dislocations are generally produced by the hand being carried too far round in the directions of pronation and supination; and of the two, dislocation forwards is the more frequent, partly, because the motion of pronation is more extensive than that of supination, and partly, because violent and immoderate force, which is often required in efforts accompanied with pronation, can seldom be necessary in any offices which the hand has to perform in a state of supination. Desault records the case of a laundress, who, by a violent pronation of her hand in wringing a wet sheet, produced dislocation forwards of the radius. The dislocation backwards of the radius has not in every case been caused by supination. Dupuytren mentions the occurrence of an example in one of the gendarmerie, where the injury was occasioned by his horse falling and his fore-arm being crushed between the horse's head and the ground. The dislocation forwards seldom occurs; and the dislocation backwards is so extremely rare, that in a long experience Desault never met with it in the living body, and only once in the dead subject; Dupuytren saw but two cases; Boyer but one; and Sir Astley Cooper has not recorded a single example.

In dislocation forwards, the fore-arm is bent, the hand being carried beyond the natural extent of pronation; there is an unnatural prominence at the posterior and inner part of the wrist, caused by the ulna; and the motions of pronation and supination are suspended. Replacement is easily accomplished in the following manner:—The arm is fixed by an assistant, and the surgeon, with the fingers and thumb of one hand, separates the bones from each other, pressing the one backwards and the other forwards, and with the other hand, he at the same time forcibly turns the hand into a state of supination; by which movement the radius is sent back to its proper position. The injury is caused by violent pronation: it is reduced by forcible supination.

In dislocation backwards the hand is carried beyond the natural extent of supination; the motions of pronation and supination are suspended; the natural prominence formed by the ulna at the back of the wrist disappears; and an unnatural projection in front of the wrist is caused by the under part of the ulna. In the example of the officer, whose case is recorded by Dupuytren, and where violent supination was not the cause of the injury, the hand was not supinated, but midway between pronation and supination. The direction of the ulna was too far forward, the lower extremity coming in front of the radius; there was an unnatural depression at the back, and an unusual prominence in front of the wrist. Replacement may be accomplished by fixing the arm, and with one hand separating the bones from each other, pressing the one backwards and the other forwards, and with the other hand forcibly producing pronation; by which means the hand, and with it the radius, is carried forward. The dislocation may be caused by supination being carried to too great an extent, and it may be reduced by forcible pronation.

Violent pronation may cause dislocation backward of the upper, and forward of the under extremity of the radius; and forcible supination is a principal means of reducing these dislocations.

Supination carried beyond the proper extent may induce dislocation forward of the upper, and backward of the under, extremity of the radius; and forcible pronation is of the greatest consequence in reducing these dislocations.

DISLOCATION OF THE RADIO-CARPAL ARTICULATION, OR WRIST JOINT.

This articulation is liable to five dislocations. Both bones of the fore-arm may be thrown forwards, backwards, inwards, or outwards, and the radius alone may be driven forward on the front of the carpus. The dislocations forwards and backwards are exceedingly rare, especially the former. The celebrated Dupuytren went even so far as to say, "that there was not a single unequivocal instance on record of a dislocation of the radio-carpal articulation, and that he invariably found these pretended accidents always turned out to be fractures of the radius near the articulation." It is now, however, quite certain that these dislocations, though rare, do occasionally take place.

1. DISLOCATION FORWARDS.

The dislocation forwards is produced by a fall on the palm of the hand during extension, and may be detected by a swelling on the fore part of the wrist, produced by the radius and ulna, and another on the back part, caused by the carpus; by an unnatural depression above the last-mentioned swelling; by the styloid processes of the radius and ulna not presenting their natural relation to the carpus, and by the hand being extended and fixed.

2. DISLOCATION BACKWARDS.

The dislocation backwards usually occurs from a fall on the back of the hand, while the hand is fixed. It is characterized by two unnatural swellings,—one on the back of the wrist, caused by the radius and ulna, the other in front, caused by the carpus; and by the hand being violently bent and fixed.

These dislocations may be distinguished from sprains by the existence of two swellings; whereas in sprains there is only one; and that does not appear immediately, but, when it does, gradually increases. For distinguishing between dislocation of the wrist and fracture of the radius near the wrist, when the inflammatory swelling renders it difficult to detect the real nature of the case, it is of importance to take hold of the hand, and move it, observing at the same time whether or not the styloid processes of the radius and ulna be movable. If the injury be a fracture, they will change their position; but if it be a dislocation, they will remain fixed.

3 and 4. LATERAL DISLOCATIONS.

The lateral dislocations are never complete, on account of the breadth of the articulating surfaces; in consequence of which some part of the under portion of the articulation still rests against some part of the upper. A projection of the carpus on the one side of the wrist, and of the radius or ulna on the other, with a fixed condition of the hand, are symptoms sufficiently diagnostic to make these injuries easy of detection. The deformity of parts is so distinct, that there can be no difficulty in recognising these accidents, and their replacement is equally easy by the following means:—

While the fore-arm is held firmly by an assistant, so as to afford the necessary counter-extension, and another assistant makes extension from the hand, the surgeon should press the displaced bones towards their proper situation. When extension and counter-extension have been used to a sufficient degree to prevent the bones from pressing against each other, the contraction of the muscles will powerfully aid in accomplishing reduction. After reduction, antiphlogistic remedies, of rather a smart character, are frequently necessary to subdue the very considerable tumefaction and inflammation which sometimes result from the injury to the soft parts; and recourse must be had to the cautious use of a splint, to prevent any motion of the hand which would be apt to cause a recurrence of the dislocation, and hinder the union of the ligaments; but care must be taken so to apply it, as not to produce any pressure, which would aggravate the local inflammation, if it should supervene.

5. DISLOCATION FORWARDS OF THE RADIUS ALONE, ON THE FORE PART OF THE CARPUS.

This is quite a different dislocation from that of the radius forwards at the inferior radio-ulnar articulation. In this dislocation the styloid process is no longer in a line with the radial side of the carpus; the under extremity of the radius forms a protuberance on the front of the carpus; the hand is fixed, and its outer border is twisted backwards, and its inner forwards. These symptoms are sufficiently diagnostic of the nature of this injury, the reduction and after-treatment of which are the same as when both bones are displaced.

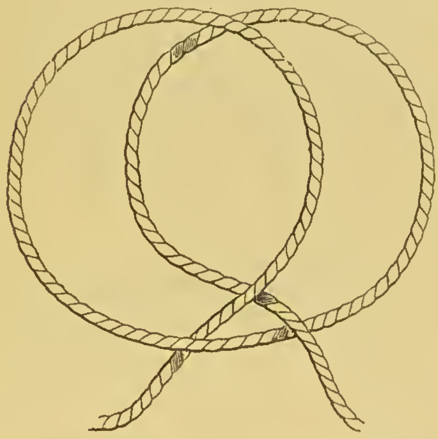
DISLOCATIONS OF THE THUMB.

The first metacarpal bone of some anatomists, the first phalanx of the thumb of others, is capable of being dislocated in four directions, namely, inwards, outwards, forwards, or backwards; but, in general, it is dislocated only forwards or backwards. Mr. Lawrence is of opinion that a dislocation backwards is the only dislocation of this bone that can take place. In many cases seen by Sir A. Cooper, the metacarpal bone was thrown inwards, between the os trapezium and the metacarpal bone of the fore-finger, so as to form a protuberance towards the palm of the hand. The thumb was bent backwards and did not admit of being brought towards the little finger. The unnatural protuberance formed by the articular end of the bone is so very conspicuous, that the nature of the accident is immediately recognised. Much pain and swelling are produced by the accident.

For facilitating reduction, Sir A. Cooper advises extension to be made with the thumb inclined towards the palm, in order to relax and diminish the resistance offered by the flexor muscles. After steady extension for a considerable time, the bone should be forced into its place by making pressure with the fingers on the head of the bone. When reduction is impracticable, Sir Astley deems it preferable to leave the case to the degree of recovery which nature will in time produce, rather than run any risk of injuring the nerves and blood-vessels, by dividing the muscles or ligaments.

Dislocation of the first Phalanx.—A more frequent, and at the same time more troublesome dislocation, because of the difficulty of its reduction, is the dislocation of the first phalanx from the metacarpal bone. The deformity of the parts reveals the nature of the injury. The extremity of the first phalanx forms a prominence on the back of the head of the metacarpal bone, and the lower part of the metacarpal bone is equally perceptible on the palmar side. In reducing it, which it is comparatively easy to accomplish in the recent state, the thumb should be inclined towards the palm; and during straight extension of the thumb, pressure should be made with the finger on the head of the extremity of the first phalanx. But after a little time has elapsed, there is often very great difficulty in effecting reduction—so much so, that Sir A. Cooper considered dislocations of the thumb as the most difficult to reduce. "In order to relax the parts as much as possible, the hand should be soaked for a considerable time in warm water; a piece of wetted wash-leather is to be as closely wrapped round the first phalanx as possible; a tape, about two yards in length, should be fastened on the leather with a knot that will not slip, such as the sailors call the clove hitch. An assistant should now firmly press on the metacarpal bone, by putting his middle and first fingers between the fore-finger and thumb of the patient, and thus make a counter-extension, whilst the surgeon, assisted by others, draws the first phalanx from the metacarpal bone, inclining it at the same time a little towards the palm of the hand. If the efforts made in this way, after having been continued ten or fifteen minutes, should not succeed, then it will be necessary to adopt another plan which is this—in addition to the apparatus already employed, let a strong worsted tape be carried between the metacarpal bone and fore-finger, bend the fore-arm round a bed-post, and let the tape be firmly

Fig. 109.



tied to it, so as to prevent the hand yielding when extension is made. To the tape surrounding the first phalanx a pulley is to be applied, and extension made, which will generally succeed."

The proposal has been suggested of dividing one of the lateral ligaments with a couching needle, or a very small knife, when reduction is impossible by ordinary means. The best authorities, in general, unite in condemning this practice on account of the frequency with which tetanus is induced by injuries of tendons and ligaments connected with the thumb. Mr. Syme, however, says :—"In cases where the difficulty proves insuperable, one of the lateral ligaments may be cut, which would certainly be better than leaving the bone unreduced, as has sometimes been the case."

Sometimes the dislocation takes place in the other direction, the metacarpal bone being forced behind the extremity of the first phalanx. Here there is less difficulty in accomplishing reduction.

The phalanges of the fingers are sometimes dislocated backwards. The accident cannot be mistaken, and reduction by means of extension is accomplished with facility.

DISLOCATIONS OF THE HIP JOINT.

It will facilitate the description of the various dislocations of the hip joint to arrange them in two grand classes, *the regular*, and *the anomalous.* Of the former class there are four different kinds, and the same number of the latter class have been recorded.

REGULAR DISLOCATIONS OF THE HIP JOINT.

The head of the thigh-bone may be thrown from the acetabulum in the four following directions, constituting the four regular dislocations :—

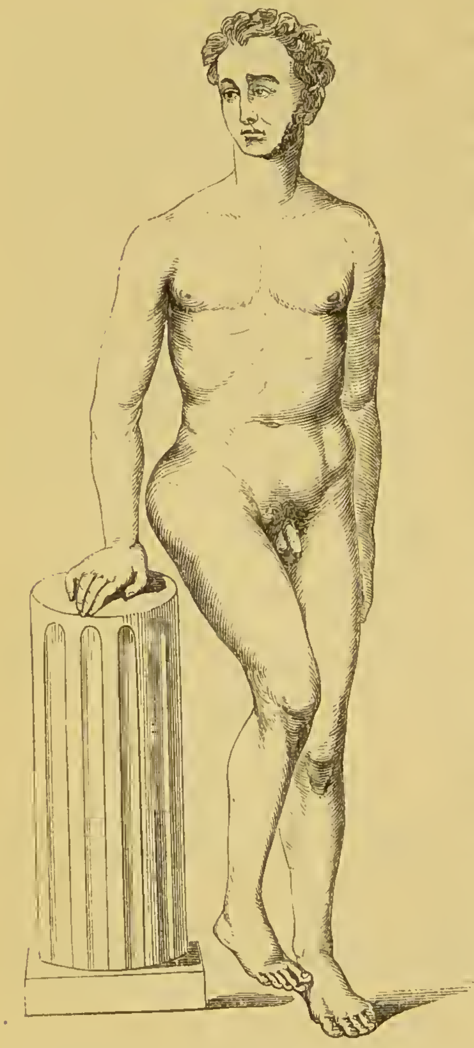
1. Upwards, upon the dorsum of the ilium. 2. Backwards, into the ischiatic notch. 3. Downwards and forwards, into the foramen ovale. 4. Forwards, upon the pubes.

With regard to the proportionate frequency of these several dislocations, Sir Astley Cooper says, that in twenty cases, you may have twelve of the first kind, five of the second, two of the third, and one of the fourth.

I. DISLOCATION UPWARDS, ON THE DORSUM OF THE ILIUM.

Symptoms.—When the bone has been displaced in this direction, the dislocated limb is more or less shortened. This symptom appears immediately, but, after the muscles have had time to contract, it increases so much, that the point of the great toe of the affected side does not extend beyond the tarsus of the other foot. The shortening will be best seen by supporting the patient in the erect posture, and comparing the position of the toes, or of the inner ankles. The thigh, leg, and foot are all inverted, so that the great toe of the disloeated extremity rests on the tarsus of the opposite foot. The knee is very slightly bent, and a little in advance of the under part of the other thigh. The limb is perfectly immovable to the voluntary efforts of the patient, nor can it be moved by the surgeon in the direction of abduction or of extension; and if it can be slightly moved in the direction of adduction or of flexion, such movements are attended with great pain. There is an unnatural swelling of the hip, caused by the upper part of the femur, and the bulging out of the glutei muscles. If the patient be thin, and the bone be not concealed by extravasation of blood and the general tumefaction of the hip, which may soon follow such an injury, the head of the femur may be distinguished on the os innominatum, with its ball directed backwards, and its trochanter major forwards, and much nearer than natural to the anterior superior spinous process of the ilium. Another symptom is, the absence of the natural projection of the trochanter major. The distinctive marks of this injury are so unequivocal that an attentive observer can be at no loss to recognise it. They may be stated briefly to be,—Shortening of the extremity; inversion; the knee slightly bent, and a little in advance; the limb immovable to the voluntary efforts of the patient, and to the surgeon in the direction of extension or abduction; absence of the natural projection of the trochanter; an unnatural swelling of the hip; and the trochanter major raised upwards and forwards, so as to be too near to the anterior superior spinous process of the ilium.

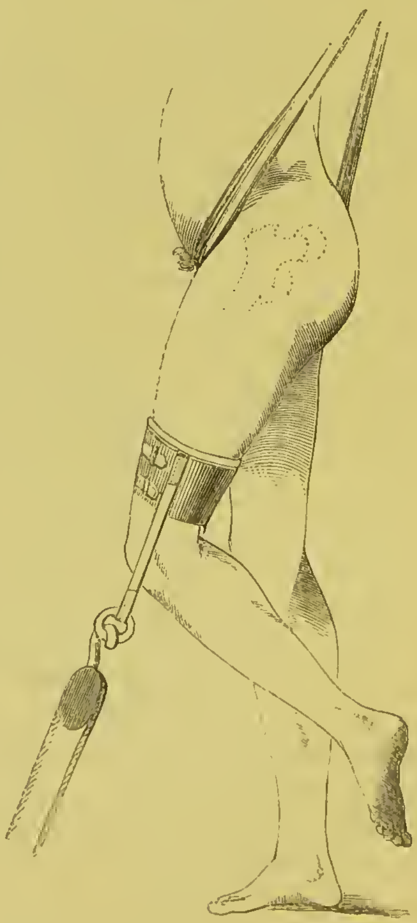
Fig. 110.



State of the parts.—The capsular, accessory, and round ligaments must be ruptured, and the muscles torn up from the dorsum ilii before the bone can occupy its unnatural situation. The upper extremity of the femur rests on the dorsum ilii, the ball being directed backwards and the trochanter forwards. It has often been a subject of inquiry, why the ball is always directed backwards, and the trochanter forwards, and why it is not thrown into the attitude in which the principal muscles of the limb would place it. In France, the explanation proposed by Boyer is considered satisfactory. He ascribes it to the strong anterior portion of capsular ligament, which proceeds from the upper and anterior part of the acetabulum to the anterior intertrochanteric line. When the bone is driven upwards, these fibres draw the trochanter towards the acetabulum, and prevent the bone from being twisted outwards, as the rotators would direct it.

Treatment.—It is not advisable to attempt reduction, without having previously weakened the muscular power. The means formerly employed for that purpose consisted of copious bleeding, followed by a dose of antimony, or small doses of half a grain every ten minutes until nausea was produced. Or, when it could conveniently be done, the patient was first bled, then placed in a warm bath, and afterwards got doses of antimony until nausea came on, when the muscles were less able to resist reduction. The patient was, in all probability, much less injured by these debilitating remedies, than by the much greater extension which would otherwise have been necessary. Instead of any of the above-mentioned proceedings, the auxiliary now employed is chloroform, which not only has the advantage of being more powerful, but also of preventing pain, and has, besides, no permanently weakening effect on the system. An assistant being in readiness with a set of pulleys, the patient should be placed on his back or opposite side on a table of convenient height, particular care being taken that he be in such a position as to have the long axis of the thigh-bone in a straight line between two rings or staples fixed in some resisting objects in opposite sides of the room. To afford the necessary counter-extension to the pelvis, a strong well-padded leather belt or girth should be passed round the limb, so as to press on the side of the

Fig. 111.



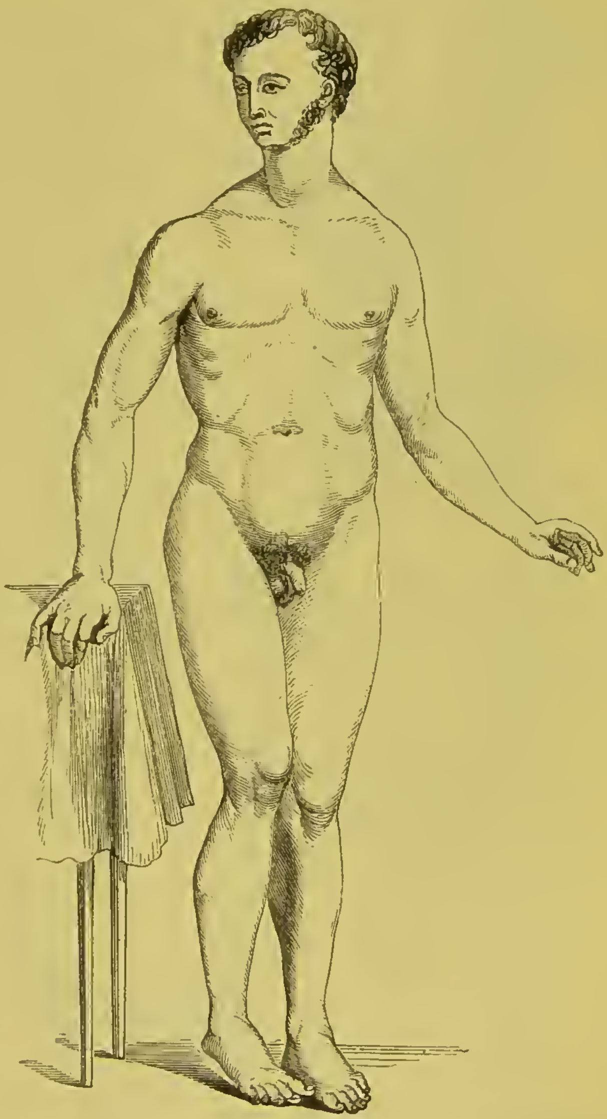
perineum (to prevent the chafing of which the padding is necessary), having its extremities directed outwards and upwards, so as to be in a line with the long axis of the thigh-bone, and fixed to one of the staples or rings before mentioned. For affording the necessary extension, a few turns of a wetted linen roller should be tightly applied to the thigh, above the knee, over which should be very firmly buckled a leather belt furnished with two straps at right angles to itself, each having a ring at its extremity. The one set of pulleys should be fixed to the rings, and the thigh being directed a little forwards across the under third of the opposite thigh, and the leg of the affected side bent nearly to a right angle, the other set of pulleys should be fixed to the other ring or staple in the room. The direction of the axis of the thigh being carefully preserved in a straight line with the extending and counter-extending forces, the extension is to be applied by the surgeon himself, or by an assistant under his direction, by drawing the cord of the pulleys. The manner of doing this is, however, of the greatest importance; it ought not to be done suddenly, or violently, but slowly, steadily, and gradually; the cord should be drawn until considerable extension be produced, when the force should not be increased, but steadily kept up; and when the muscles have had time to stretch, it should then be increased; and after another interval, during which the same degree of extension is preserved, the force should again be increased. When the ball of the femur is brought near to the acetabulum, it will be necessary for the surgeon to employ an assistant to keep up the extension; while he himself, taking hold of the femur, endeavours with one hand to raise the head of the bone from the ilium, by pressing upwards with the hand placed under the thigh,—the object being to diminish the resistance offered by the margin of the acetabulum to the ball of the bone gliding over it; and with the other hand he endeavours to rotate the thigh outwards for the purpose of inclining the trochanter backwards and the ball of the bone downwards and forwards. The advantage of attempting rotation must be evident from what has been stated regarding the position of the bone in this dislocation. The bone seldom returns with a snap when the pulleys are employed, from the muscles being so much worn out that they are not able to exert that sudden and powerful contraction which commonly accompanies reduction of a dislocation. The surgeon must, therefore, determine by the absence of the symptoms of dislocation that the reduction has been accomplished.

The above are the best appliances for the application of the extending and counter-extending forces; but if they cannot be obtained, a sheet or tablecloth, with a quantity of tow or linen placed so as to diminish the danger of chafing, may be used for the latter purpose, and a skein of worsted, to which the pulleys may be fixed, or the former.

II. DISLOCATION BACKWARDS, INTO THE ISCHIATIC NOTCH.

Symptoms.—In this, as in the last dislocation, we have shortening, inversion, an advanced position of the knee, and a fixed condition of the limb; but the three first-mentioned symptoms are to a less extent than in the former case. The shortening and inversion are such, that the point of the great toe rests upon the ball of the great toe of the opposite foot, instead of upon the tarsus. The knee is less advanced, and is slightly bent; and when the patient is placed in the erect attitude, the toes only touch the ground. There is an unnatural projection on the back part of the hip; the trochanter major is too far forward; and the natural projection formed by it is lost.

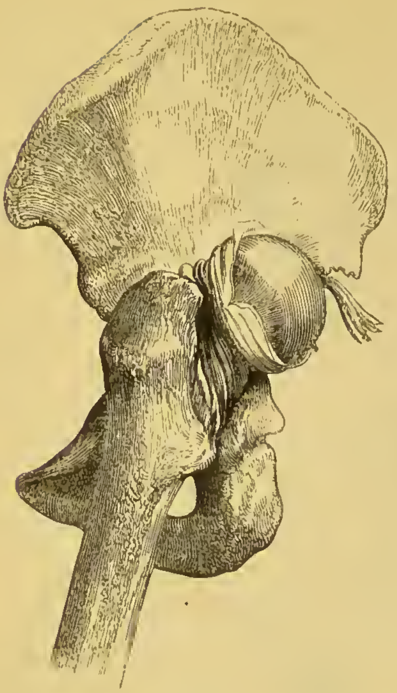
Fig. 112.



State of the parts.—The capsular, accessory, and round ligaments are ruptured, and the head of the femur rests on the pyriformis muscle, above the sacro-sciatic ligaments and at the edge of the notch, with its ball directed backwards and the trochanter forwards.

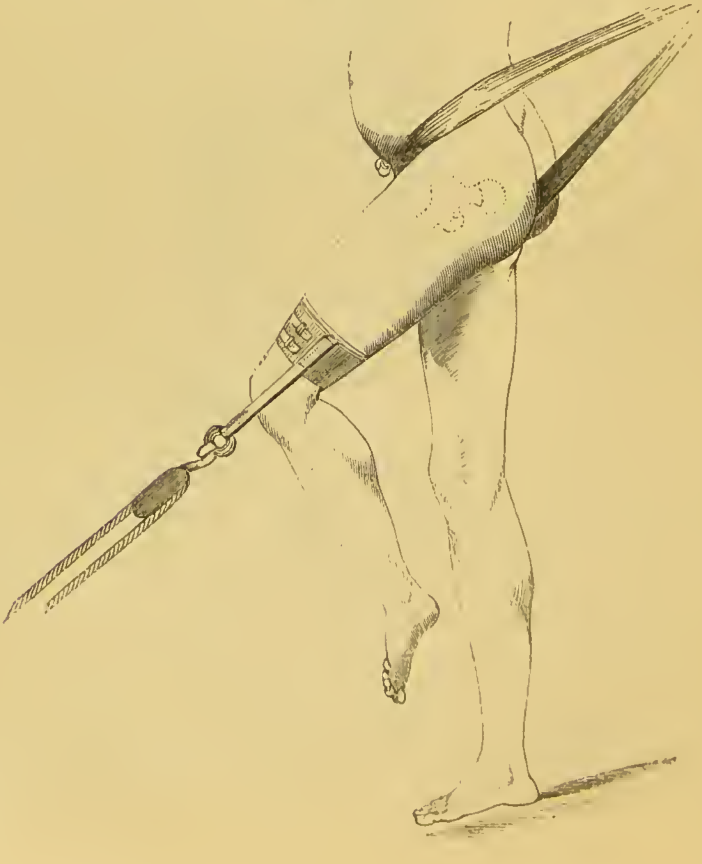
Treatment.—Reduction is exceedingly difficult, but it is to be effected in the same manner, as in the former dislocation, with the following peculiarities, which require careful attention. The direction of the extending force should be across the middle, instead of across the under third, of the opposite thigh; and as the extending and counter-extending forces must always be in a line with each

Fig. 113.



other, the direction of the mechanism for fixing the pelvis, although upwards and backwards, should be more directed backwards than in the reduction of the former injury. The sciatic notch, where the ball of the bone rests, is posterior to the acetabulum, and from the oblique position of the pelvis in the human body, a little higher up; and as the object of extension is to draw the ball forwards and a little downwards, the reason of the peculiarity in the direction of the traction must be obvious. While extension is being made, which ought to be done with the patient placed on his opposite side, the ball of the thigh-bone should be raised out of the ischiatic notch, and over the edge of the aceta-

Fig. 114.



bulum. With this view some recommend that a round towel be placed under the upper part of the thigh and over the shoulders of an assistant, who at the same time resting both his hands on the patient's pelvis, obtains a great power over the dislocated bone.

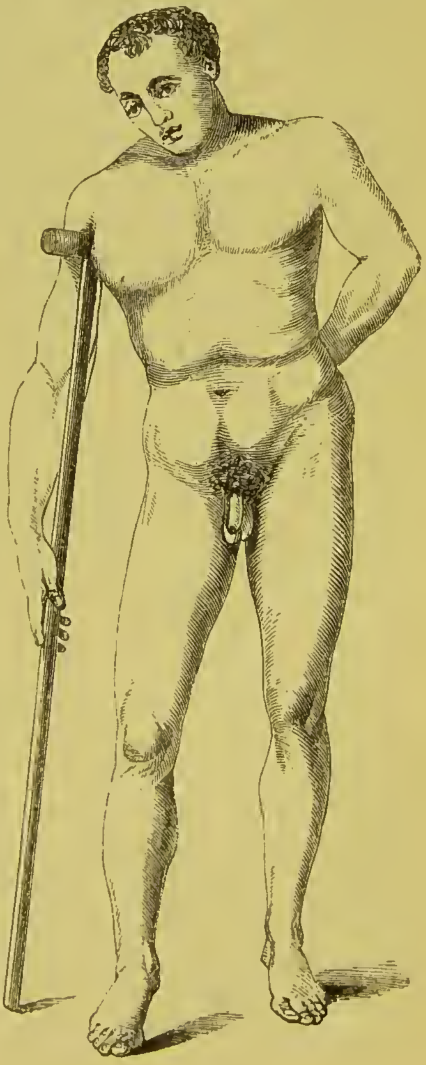
As a symptom, the knee is less advanced than in the former dislocation; but in reduction, it requires to be raised further forward, and crossed over the other thigh, higher up than is necessary, or proper, in replacing the bone in dislocation upwards.

III. DISLOCATION DOWNWARDS AND FORWARDS, INTO THE FORAMEN OVALE.

This dislocation has been known to occur in consequence of a fall from a horse, with the thigh under the body of the animal. It has also been sometimes occasioned by the fall of a heavy weight on the thigh, while the limbs were separated. I once saw an instance of it caused by the person jumping in great haste out of bed, so that while the left foot reached the floor, the right was entangled by the blankets in bed, and in consequence, the ball of the femur was driven against the anterior and under aspect of the joint, thus occasioning a dislocation downwards and inwards.

Symptoms. — The limb is elongated and violently abducted, nor can it without great pain and difficulty be brought near to the other limb. If the patient be raised to the erect attitude, he leans to the affected side; or, if the trunk be kept perfectly erect, the knee is very much in advance; the rationale of which is, that the psoas magnus, and iliacus internus, are put very much on the stretch, and the patient endeavours to diminish the painful tension, by inclining the trunk to the affected side, or, if that be prevented, by bringing the thigh forward. The toes are generally neither

Fig. 115.



inverted nor everted; the trochanter major is less prominent than usual, and there is an unnatural hollow below Poupart's ligament.

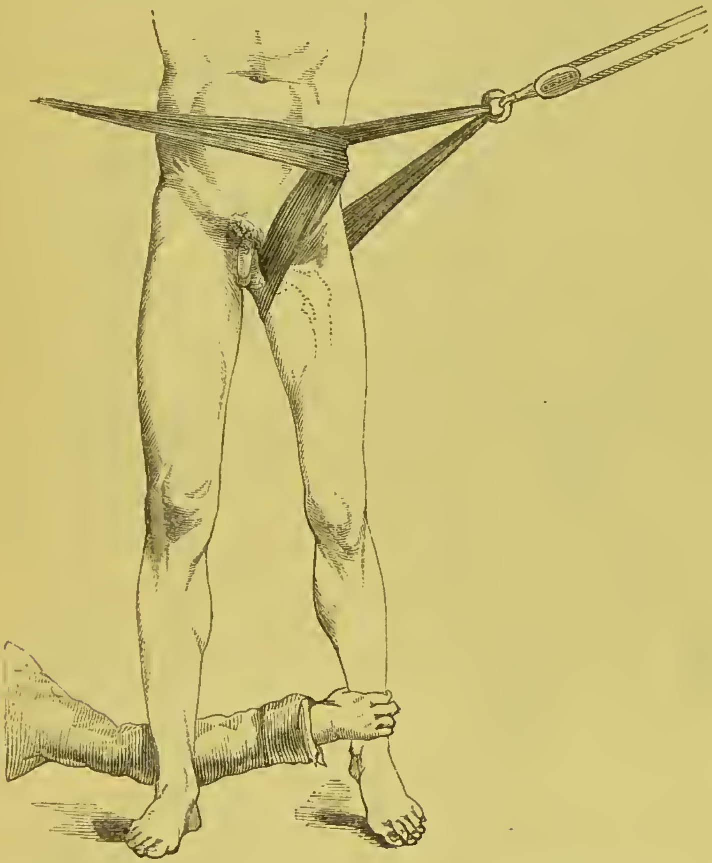
State of the parts.—The ball of the femur is in front of the foramen ovale, resting on the obturator externus muscle; and it is important to observe, that the ball is directed inwards, and the trochanter major outwards. There is rupture of two of the five ligaments of the hip joint, namely, the capsular, and the round. On this last point, however,—the rupture of the round ligament, a difference of opinion exists. Sir Astley Cooper believed that in every instance it must be ruptured, and records a dissection of a dislocation in which he found it so, whereas the celebrated Delpech, although he admits that it is sometimes ruptured, asserts that this is not always the case, and relates some cases in which he found it unbroken. Some found their opinion, that the ligamentum teres is not necessarily ruptured, on the fact, that in the dead body, the ball can be placed on the front of the foramen ovale, without rupture of the ligament. I have often in the dead body, after removing all the muscles, and cutting the capsular ligament, placed the ball of the femur in this situation; but it can only be done with the trochanter directed inwards and the ball outwards, in short, by turning backwards the part of the femur which is naturally directed forwards, and leaving the part of the ball to which the round ligament is attached, very near to the margin of the acetabulum. This, however, is not the position of the femur in the dislocation; on the contrary, the ball is directed downwards and inwards, and it will be found impossible in the dead subject, to place it in that position without first cutting through the round ligament. As has already been stated, Sir Astley Cooper is of opinion, that the round ligament is always ruptured; and that the accident cannot occur to a living person, except when the limb is in a state of abduction, in which position the ligamentum teres is upon the stretch, and therefore, if the force applied go so far as to dislocate the joint, the ligamentum teres must first give way.

Treatment.—The ball of the femur is too low down, and too near the mesial plane. It may be reduced in one or other of the four following ways:—

1st. The patient is laid on a table on his uninjured side. The pelvis is fixed by a belt placed round it, and secured to the table. Extension is made by another belt placed under the thigh, the edge of which touches the perineum, and pulleys are attached directly above the patient. It is necessary for the surgeon to press down the ankle of the affected side.

2nd. Place the patient on his back. Counter-extension is made by a belt or girth, placed round the pelvis, the concavity of the belt being in contact with the injured side, and secured to a staple or some resisting object. The extending force is directed upwards and outwards. After extension has been continued for some time, the surgeon should pass his hand behind the ankle of the sound limb, and grasping the other ankle, should draw it inwards, towards or beyond the mesial plane of the patient's body. While this is being done, the belt in the perineum acts as a fulcrum, the femur as a lever, and the hand as the power ; and by bringing the under part of the femur inwards, and a little backwards, the ball is sent upwards and outwards. This is Sir Astley Cooper's method.

Fig. 116.



3rd. Mr. Hey, of Leeds, reduced this dislocation in the following manner :—He desired the patient to sit upon the front of the bed, astride of the bed-post, and to grasp it ; he then fixed two towels to the injured limb, and two assistants made extension. While the extension was continued, he crossed the injured thigh over the sound one, and at the same time rotated the limb.

4th. Mr. Hey, in another case, flexed the thigh to such an extent as to form an acute angle with the trunk, and then by a rotatory motion of the thigh effected reduction.

IV. DISLOCATION FORWARDS, UPON THE PUBES.

Symptoms.—The limb is shortened, usually to the extent of an inch. The knee and foot are turned outwards, and the knee is drawn forwards and away from the other. The limb cannot be moved at all by the voluntary efforts of the patient, and but very slightly by the surgeon; nor can it be rotated inwards, although it may be pressed a little forwards and backwards. The head of the thigh-bone may be distinctly felt in the groin, giving rise to an unusual protuberance. The roundness of the hip is lost in consequence of the trochanter major being drawn too near the mesial line, and the space between the trochanter major and the anterior superior spinous process is

Fig. 117.

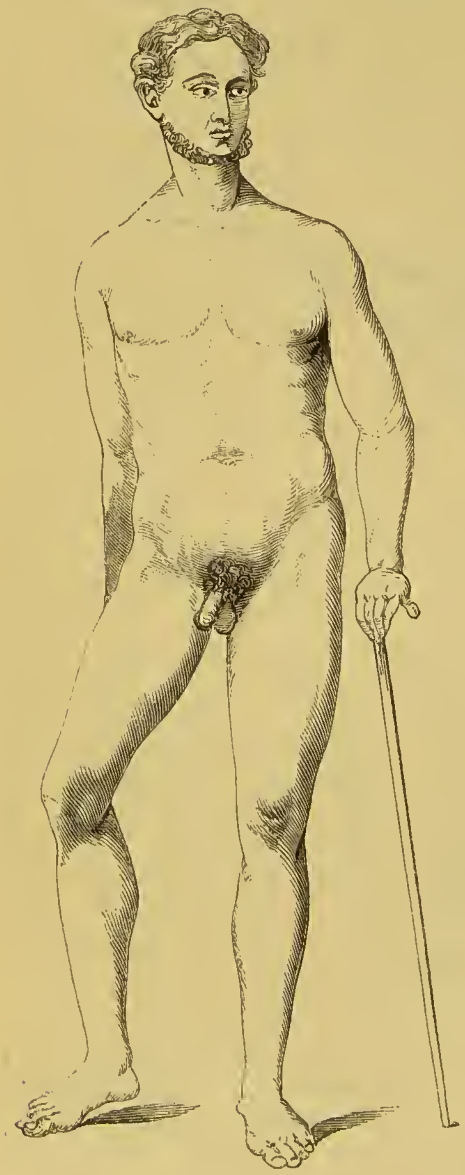
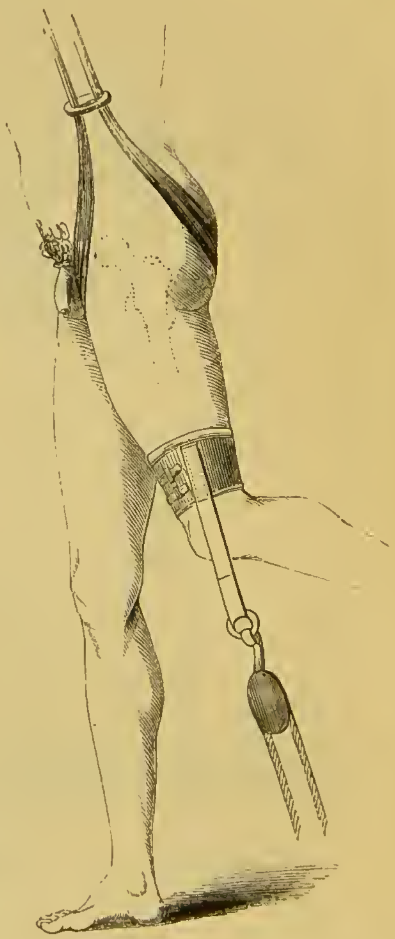


Fig. 118.



diminished. There is frequently numbness or pain, from pressure on the anterior crural nerve. From these symptoms, compared with what has been stated as to the symptoms in fracture of the neck of the thigh-bone, the diagnosis may be easily made out.

State of the parts.—The ball of the femur rests on the anterior part of the pubes, with the trochanter directed backwards. The ball is on the horizontal part of the pubes, superior to the obturator foramen. In some cases it is sent up so high as to be hooked into the pelvis. The capsular and round ligaments must be ruptured, and the accessory may be injured. In a dissection mentioned by Sir Astley Cooper, the head and neck of the femur were driven under the psoas magnus and iliacus internus muscles, which, together with the anterior crural nerve, were thus put much upon the stretch on their way downwards. In a practical point of view, it is of great importance to remember, that the trochanter is directed backwards, and the ball forwards,—this being the very reverse of the position of these parts in the dislocations upwards and backwards.

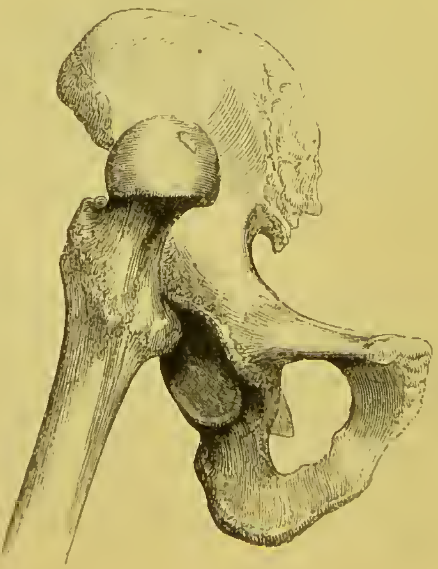
Treatment.—The knee should be pressed a little downwards. The counter-extension should be made over the trunk of the patient, and the extension in a line with it, so as to draw the thigh downwards and backwards. While extension and counter-extension are being employed, a towel should be placed under the upper part of the thigh, and an assistant should lift up the head of the bone over the pubes and the edge of the acetabulum, the surgeon at the same time endeavouring to send the ball backwards by effecting rotation inwards of the thigh.

ANOMALOUS DISLOCATIONS OF THE HIP JOINT.

The following anomalous dislocations are recorded:—

1. Dislocation upwards, with the ball below the anterior superior spinous process of the ilium, the neck against the ridge between the anterior superior and anterior inferior spinous processes, and the trochanter directed backwards. An instance of this dislocation occurred in the experience of Mr. Gibson of New Lanark, and was successfully treated by him and Dr. Cummins.

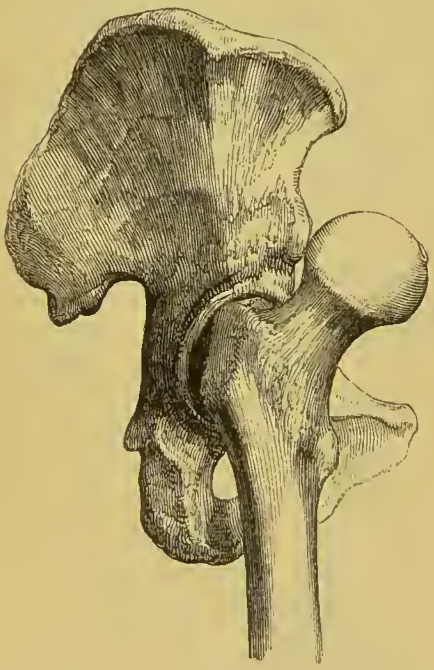
Fig. 119.



The symptoms were the following:—The limb was shortened fully three inches, and so fixed that it could not be lengthened in any degree; the limb and toes were everted, rotation inwards was impossible, and any attempt to effect it caused great pain; adduction and abduction were exceedingly painful and difficult, but very limited flexion could be performed with less pain. There was a tumour under the anterior superior spinous process, obedient to the motions communicated to the thigh, the trochanter major could not be felt, and the hip was flattened. The position of the bone was believed to be that which is here described; and, for the accomplishment of reduction, nausea was induced by means of tartar emetic; and then, while counter-extension and extension were being made by means of pulleys, Mr. Gibson raised the thigh-bone, by means of a round towel placed under the thigh and over his own shoulders, at the same time pressing the knee towards the opposite thigh, and forcibly rotating it inward.

2. Dislocation upwards, with the ball between the anterior inferior spinous process and the junction of the ilium and pubes, the trochanter being directed backwards.

Fig. 120.



A case of this description is recorded by Mr. Morgan in Guy's Hospital Reports. The following were the symptoms:—Shortening of the limb to the extent of two inches, extreme eversion of the foot, and a tendency on the part of the injured limb, when left to itself, to cross the sound one, the heel of the former resting on the instep of the latter. The ball of the bone could be discovered under Poupart's ligament; the trochanter could not be felt; and the limb could be moved to a certain extent in any direction except rotation.

The bone was believed to be in the position above described. Mr. Morgan accomplished reduction by counter-extension and extension without pulleys, employing at the same time forcible rotation inwards of the limb. In order to obtain a greater power in effecting rotation, Mr. Morgan bent the leg at a right angle to the thigh, and rotated the thigh by holding the knee with one hand, and the foot with the other.

3. Dislocation downwards on the tuberosity of the ischium with eversion of the foot.

Mr. Keate was called to attend a gentleman who had suffered this dislocation by his horse falling backwards upon him into a narrow ditch, in which position he remained for some time, with his heels directed upwards and the horse's back next to his thigh.

The limb was elongated more than three inches; the leg was bent on the thigh, and the thigh bent on the pelvis; the thigh was carried very far away from the other; the knee and foot were much everted, and the trochanter exceedingly depressed. The ball of the bone was on a level with the tuberosity of the ischium, and it was believed that it had been brought into this situation by the struggling to get released from under the animal, after it had first been dislocated in front of the foramen ovale. In short, it was supposed, that it had been first sent in front of the foramen ovale, and afterwards from thence to the tuberosity of the ischium; and, therefore, in accomplishing reduction, it was first brought from the tuberosity of the ischium to the front of the foramen ovale, and afterwards from thence to the acetabulum.

4th. Dislocation of the ball on the tuberosity of the ischium, with shortening of the limb, and violent inversion of the foot.

A maniac became the subject of this dislocation, in consequence of leaping from a window in a third story. In falling, his thigh struck against the railing, and was violently driven upwards. He died in about an hour, and as he was evidently sinking from other injuries, the dislocation was not reduced. The limb was shortened and inverted; the thigh was bent and immovable, crossing the pubes obliquely to the opposite side. On dissection, the head of the femur was found to be above the quadratus femoris muscle, and opposite to the upper part of the tuberosity of the ischium. The ramus of the ischium and the ilio-pubic symphysis were fractured, in consequence of which the injury cannot strictly be considered a simple case of a new anomalous dislocation.

The ball of the femur has been found in some other situations than those mentioned above; but so far as my reading extends, in almost all such recorded cases, other injuries, such as fractures, have accompanied the displacement, so that these cases cannot properly be considered as examples of new dislocations, but rather as showing how the combination of other injuries with dislocation may affect the position of the bone.

DISLOCATIONS OF THE PATELLA.

The patella is liable to three dislocations, two of them common, and the third, of which there are some varieties, extremely rare, and difficult of reduction. The common dislocations are inwards and outwards, the latter being much the more frequent. They may be complete or partial. In the third dislocation, the bone undergoes a semi-revolution on its long axis, so that only one of its edges is in contact with the femur.

Each lateral dislocation may be the consequence of direct violence, but the dislocation outwards is often occasioned by muscular contraction. See causes of dislocations in the section on Dislocations in general.

Symptoms.—The knee is immovable to both the patient and the surgeon; there is an unnatural depression in front of the joint, and an unusual swelling on the inner or outer side of the femur, according to the direction of the dislocation.

Treatment.—Reduction is effected by raising the trunk to the erect posture, elevating the leg so as to relax the rectus and triceps muscles, and then pressing the patella inwards or outwards according to the nature of the injury. Dislocation outwards has sometimes been reduced by elevating the limb and producing forcible flexion of the knee joint.

The dislocation in which the patella makes a semi-revolution on its own axis, so as to have one of its margins in contact with the femur and the other with the integument, is so very rare that, as far as I know, there are only three cases recorded.

One case, that of a private of the 2nd Life Guards, was successfully treated by Mr. Mayo and Mr. Broughton. The injury was caused by a stroke on the right knee from the knee of another soldier, as the two opposite lines rode through each other. One edge of the patella rested on the outer surface of the external condyle, the other was directed outwards, and the fore part of the patella was directed forwards and inwards. Various methods were tried without success to effect reduction, which was at length accomplished by suddenly bending the knee so as to carry the heel back to the hip, when the patella returned to its proper situation.

In this case, one edge of the bone was in contact with the outer part of the external condyle; but in each of the other two cases, the one edge was in contact with the trochanter of the femur, and the other was directed forwards. Of these two cases, one occurred in the experience of Mr. Welling of Hastings, and in that instance the integuments were very much elevated in front of the joint by one edge of the bone, the other edge resting against the femur. Replacement was effected by pressing the edges in opposite directions while the leg was extended.

The other case is published in a German journal, "Rust's Magazin," and is quoted in the "London Medical Gazette." The accident happened to a young hussar, who was riding without stirrups, and was occasioned, as in the case first mentioned, by the knee having been forcibly struck by a soldier in the opposite rank. The patella was half turned on its axis, so as to have one edge directed backwards and resting on the outer edge of the trochlea of the femur, while the other edge projected directly forwards; the posterior surface was directed outwards, and the anterior inwards.

The surgeon, finding it impossible by any force to restore the patella to its proper situation, had recourse to the expedient of cutting through the quadriceps tendon, where it is attached to the patella, but not even then could he effect replacement. Unhappily, the incision extended into the joint, and was followed by suppuration, in consequence of which the patient died about eleven months after the accident.

DISLOCATIONS OF THE TIBIA FROM THE FEMUR.

The tibia may be dislocated in four directions,—inwards, outwards, backwards, or forwards. The last two are complete; the other two, or lateral dislocations, are partial.

THE LATERAL DISLOCATIONS.

The two lateral dislocations are easily distinguished by the appearance of the deformity, and the immovable condition of the joint. They are reduced by extension and counter-extension, and by pressing the tibia inwards or outwards, according to the direction of the dislocation. The external condyle of the femur, in the dislocation outwards, rests on the internal condyle of the tibia; in the dislocation inwards, the internal condyle of the femur rests on the external condyle of the tibia. In both dislocations, the tibia is a little twisted.

DISLOCATION FORWARDS.

Symptoms.—The symptoms of this dislocation are a great swelling in the popliteal region, caused by the under extremity of the femur, and another in front of the femur, caused by the tibia, patella, and fibula being driven upwards and forwards upon it; a shortening of the leg, to an extent varying according to the distance that the tibia is sent up upon the femur; a very slight flexion of the leg upon the thigh, so as to form a very obtuse angle; and the extremely unnatural appearance caused by the deformity. In some cases, the pain has been very severe; and from the pressure of the femur against the popliteal artery, the pulsation of the anterior tibial artery has been found in some examples to be interrupted; in others, the condition of the vessel has not been observed.

Reduction.—Reduction is easily accomplished by counter-extension applied to the thigh, and extension to the leg, in the direction of the long axis of the displaced tibia; and while these are being employed by assistants, the surgeon, placing one hand on the popliteal space against the extremity of the femur, and the other in front of the joint against the tibia, presses in opposite directions so as to send the femur upwards and forwards, and the tibia downwards and backwards. After reduction, the limb should be laid straight, and precautions taken to prevent inflammation. If, notwithstanding these precautions, inflammation should occur, active remedies must at once be employed to subdue it.

DISLOCATION BACKWARDS.

Symptoms.—A shortened state of the limb, the leg bent very much forward, a swelling in the popliteal space caused by the tibia, another in front caused by the femur, and a great depression below it, in the situation of the ligamentum patellæ, are the symptoms of this dislocation.

Reduction.—The method of reduction is the same as in the last dislocation, except that the surgeon should press the extremity of the femur upwards and backwards, and the head of the tibia downwards and forwards, while extension and counter-extension are being made.

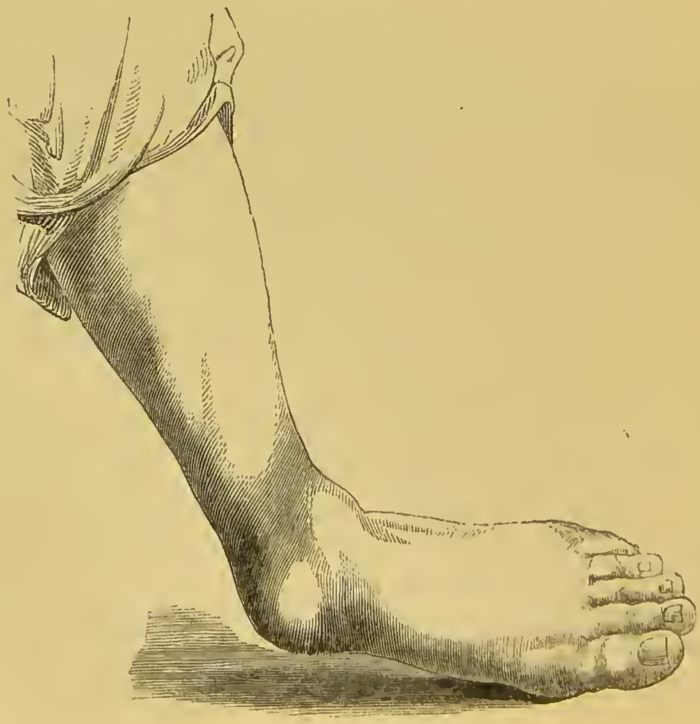
DISLOCATIONS OF THE ANKLE JOINT.

The ankle joint, which is formed by three bones, the tibia, fibula, and astragalus, and strengthened by five ligaments, the two tibio-tarsal and the three peroneo-tarsal, is liable to five dislocations. The tibia may be displaced from the astragalus, inwards, outwards, completely forwards, partially forwards, and backwards.

DISLOCATION OF THE TIBIA INWARDS.

Symptoms.—This dislocation may be readily distinguished by the great projection of the malleolus externus against the common inte-

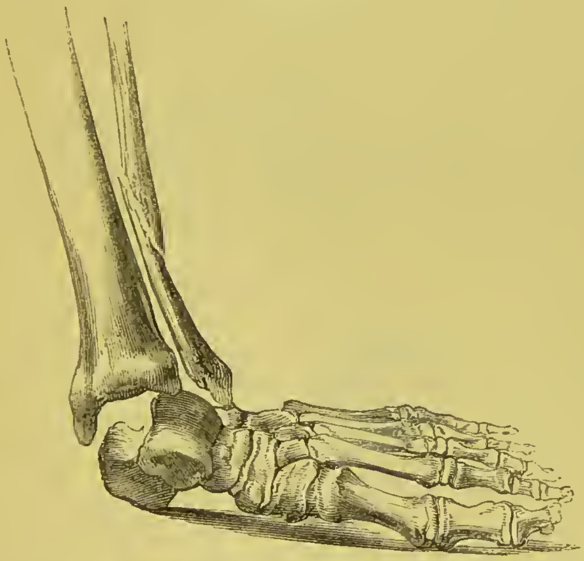
Fig. 121.



gument, by the foot being turned outwards, by its inner edge being directed downwards, and by the depression about two or three inches above the malleolus externus, where crepitus may be easily detected. The pain is very great, and the swelling considerable; the foot can be moved by the surgeon without difficulty, and when the patient is in the erect attitude, the inner edge only can be applied to the ground.

State of the parts.—The tibia is drawn inwards, and before it can be brought into this position the tibio-tarsal ligaments must be ruptured, and the fibula fractured. This fracture takes place about two or three inches above the joint, and furnishes an explanation of some of the symptoms above mentioned. The under part of the fibula remains attached to the tarsus by the peroneo-tarsal ligaments which are entire.

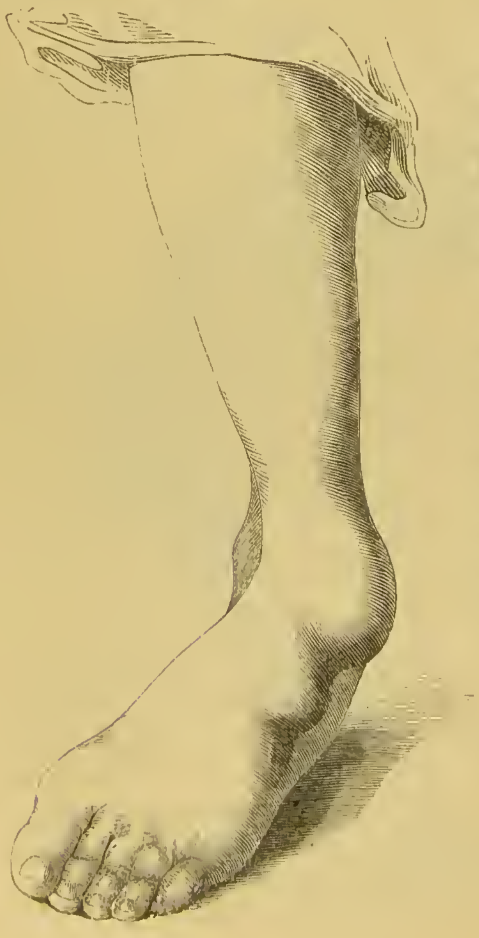
Fig. 122.



Besides fracture of the fibula and rupture of the tibio-tarsal ligaments—conditions which always exist in this accident—there is often oblique fracture of the tibia, directed so as to break off from the shaft of the bone that part of the tibia which enters into the formation of the inferior tibio-fibular articulation. The fragment thus broken off remains connected with the malleolus externus, while the tibia, entire along the whole of its inner aspect, is carried inwards along with the part of the fibula above the fracture.

Treatment.—For accomplishing reduction, the surgeon should direct the patient to be placed upon his back, with the thigh raised perpendicularly, and the leg bent back so as to make a right angle with the thigh. In this position the gastrocnemius muscle will be relaxed, and the extremity will be conveniently placed for applying the necessary extension and counter-extension. Surgeons have sometimes experienced difficulty in accomplishing reduction, from attempting it when the limb is extended, and the gastrocnemius thereby put upon the stretch. One assistant should afford the necessary counter-extension by holding the thigh, and another the necessary extension, by drawing the foot in a line with the long axis of the leg, preserving the foot, at the same time, midway between flexion and extension of the ankle joint, while the surgeon endeavours to press tho tibia outwards, so as to bring it into contact with the upper surface of the astragalus. After reduction, the limb should be placed upon its posterior part, with the leg a little bent on the thigh, and the foot midway between flexion and extension,—a position which will be favourable to the uniform relaxation of the muscles. Until the fibula becomes entire, and the tibio-tarsal ligaments unite, appliances must be used for preventing the foot from being drawn outwards; for which purpose, two splints, each having a foot-piece, may be employed, or one splint, without a foot-piece, applied to the inner, and one, with a foot-piece, applied to the outer side, to compensate for the want of resistance naturally offered by the fibula to the foot being drawn outwards. The most suitable means for keeping the splints in their proper position are loop or buckle-bandages. Some cotton-wool should be used to prevent the splints from pressing unpleasantly against the limb and foot. A point of the greatest importance is, to apply the splints so very loosely at first, as to make it impossible for them to prove injurious by producing pressure upon the affected parts, which often swell to a very considerable extent, in consequence of inflammation supervening. After what has been stated regarding the different varieties of apparatus for retaining the foot in its proper position in fractures, it is unnecessary here to refer to other appliances for the treatment of lateral dislocations of the ankle; for a description of them, and their mode of operation, I beg to refer to the section on Fractures of the Leg.

Fig. 123.

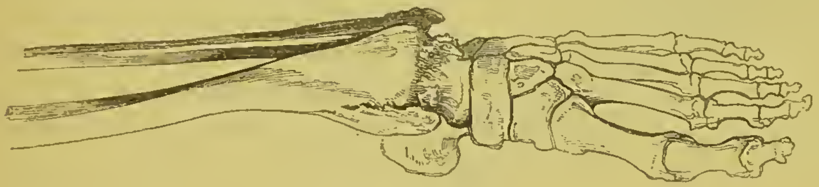


DISLOCATION OF THE TIBIA OUTWARDS.

Symptoms. — The malleolus externus projects against the common integument, forming a remarkable swelling in that situation, the foot is turned inwards, and its outer edge rests upon the ground.

State of the parts.—The tibia cannot be sent to the outer side of the astragalus, the position which it occupies in this dislocation, unless the malleolus internus be fractured. The dissevered malleolus remains attached to the tarsus by the tibio-tarsal ligaments. The fibula is sent outwards from the tarsus, and the peroneo-tarsal ligaments are usually ruptured; sometimes they are entire, but in that case the fibula is fractured above the malleolus, and the under part of the fragment remains attached to the tarsus, while the upper part of the same fragment is bent outwards. The condition of the parts, therefore, may be stated to be,—that the malleolus internus is broken off from the tibia, and remains attached to the tarsus by the tibio-tarsal ligaments, and the peroneo-tarsal ligaments are ruptured; or, the two malleoli are fractured, and the peroneo-tarsal ligaments are entire. That such are the conditions in this dislocation I am fully satisfied.

Fig. 124.



From Cooper.

Treatment.—The method of reduction differs from that in the former dislocation in this respect only, that the surgeon presses the bones inwards instead of outwards. After reduction, the attitude and the treatment are precisely the same, except that if one splint only have a foot-piece, it must be applied to the inner instead of the outer side; because the object of the foot-piece is to preserve the foot in its proper position, and in this dislocation the foot has a tendency to be drawn inwards. This dislocation may also be very conveniently treated by the different appliances mentioned in the description of the treatment of fractures of the leg. In the two lateral dislocations, if Dupuytren's splint be used, it must always be fixed to the side opposite to that towards which the foot is in danger of being drawn; because, in this case, it is not the splint that prevents displacement, but the bandage, which fixes the foot to the splint.

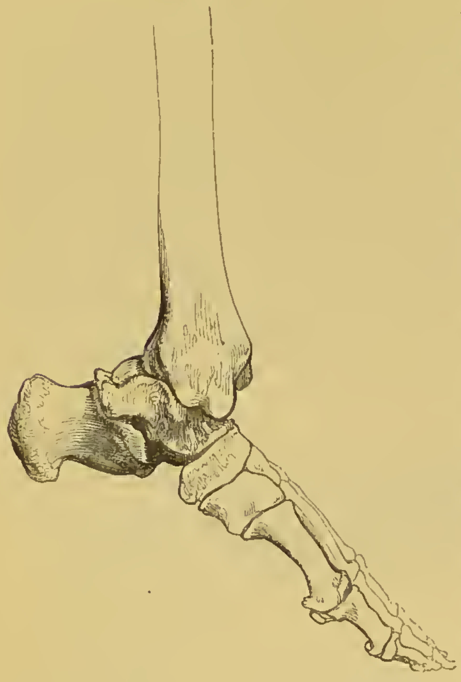
DISLOCATIONS FORWARDS.

These, as has been already stated, are two—the complete, and the partial.

Symptoms.—The heel is lengthened, fixed, and drawn upwards, the part of the foot before the leg is proportionally shortened, and the toes are depressed. These symptoms in the two dislocations differ merely as to their extent. In the complete dislocation, there is an evident depression in front of the tendo Achillis, and the foot is even more rigidly fixed than in the partial dislocation.

State of the parts.—In the complete dislocation the fibula is fractured, and the fragment remains attached to the tarsus by the peroneo-tarsal ligaments, the tibio-tarsal ligaments are ruptured, and the tibia rests on the os naviculare, and the os cuneiforme internum. In the partial dislocation, also, the fibula has been found fractured, the tibio-tarsal ligaments ruptured, and the tibia resting partly on the astragalus, and partly on the os naviculare.

Fig. 125.



Treatment.—Reduction is accomplished as in the lateral dislocations, except that the bones of the leg should be pressed backwards while extension and counter-extension are being made, and the extension applied to the foot should be directed so as to bring the astragalus in a line with the long axis of the leg. The limb should be placed in the same attitude as in the former dislocations, and, by bandaging the leg and foot to two splints with foot-pieces, it is possible to keep the bones of the leg from slipping forwards; but by far the most efficient and convenient retentive apparatus for the treatment of this injury is Amesbury's double-inclined plane. By means of it, the bones of the leg can easily be kept from sliding forwards, until the fractured portions of the tibia unite, and the ruptured ligaments are restored.

DISLOCATION OF THE TIBIA BACKWARDS.

This is an extremely rare injury. Sir Astley Cooper never saw this dislocation. I once had an opportunity of seeing an instance of it in a girl fourteen years of age. When I saw the patient, about two years had elapsed from the occurrence of the dislocation, and no attempt had been made meanwhile to accomplish reduction, the surgeon who first saw the case after the injury not understanding the nature of it. The symptoms were,—great lengthening of the foot before the two malleoli; the heel and back of the leg were in a line with each other, so that there was no projection whatever of the foot behind the leg; the malleoli did not appear to have been fractured, but were equally driven backwards, so as to bear their natural relations to each other; and the foot did not present any twisted appearance. When the girl was raised to the erect attitude, and when she pressed with any weight upon the foot, its anterior extremity bent upwards, in consequence of which she was unable to use the foot in walking. In this case, the tibio-tarsal and peroneo-tarsal ligaments must have been ruptured; the malleoli appeared to be free from fracture, and the tibia rested upon the upper part of the calcaneum.

Treatment.—For accomplishing reduction in a recent case, the patient should be placed in the same attitude as in the reduction of the former dislocations; counter-extension should be applied to the thigh by one assistant, and extension to the foot by another; and while the foot is being drawn in a line with the long axis of the leg, it ought, at the same time, to be carried backwards, so as to bring the astragalus underneath the tibia. While counter-extension and extension are being made, the surgeon should endeavour to press the tibia forwards. Amesbury's double-inclined plane, with a large pad placed between the splint and the back of the leg, immediately above the heel, will be found the most convenient retentive apparatus.

A RARE DISLOCATION OF THE ANKLE JOINT.

In addition to the above dislocations of the ankle joint, a curious case is recorded of an accident of five years' standing, in which the astragalus was thrust up between the tibia and fibula without fracture of these bones.

COMPOUND OR OPEN DISLOCATION OF THE ANKLE JOINT.

Together with displacement of the bones of the leg in any of the directions above referred to, there may also be a wound of the soft parts laying open the cavity of the joint, constituting what is called a compound or open dislocation. The cause of the wound may be the protrusion of the bones through the soft parts, or the tearing of the soft parts by some hard body, against which the limb may have been pressed. The former is the more frequent cause, but in whatever way produced, this injury is always of a very serious character. Inflammation of the synovial membrane, and irritative fever, are the usual consequences of this condition; and extensive suppuration, destruction of the cartilages, and gangrene of the soft tissues are the local results principally to be dreaded from that inflammation. These open dislocations were at one time considered to be so dangerous, that immediate amputation was deemed not merely expedient, but absolutely necessary to save the life of the patient. But in so many cases, even with very serious complications, the limb has been saved, and the treatment been successful, that no surgeon of the present day would think of amputating on account of a dislocation being compound, unless it were attended by other extremely unfavourable complications. In the greater number of cases, the practice to be followed is, to reduce the dislocation, bring the edges of the wound together, and treat the case as the common rules of surgery indicate.

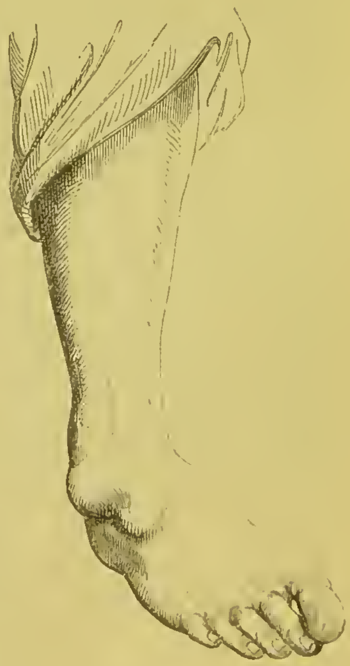
There are, however, certain conditions which render amputation advisable and necessary, the principal of which are :—An extremely shattered condition of the bones ; a very extensively lacerated wound ; severe and extensive contusion of soft parts about the joint, so as to make it probable that sloughing to a great extent will take place ; division of the larger blood-vessels, together with an extensive wound ; a very irritable or debilitated constitution ; or the advanced age of the patient. Such are the chief circumstances which render it judicious for the surgeon to recommend immediate amputation, rather than endanger the life of the patient by attempting to save the limb. When amputation is deemed necessary, the proper period for its performance is before the occurrence of irritative fever ; if that period be allowed to pass by, another may not occur in which the operation could with propriety be performed. The above conditions in many instances justify immediate amputation. Sometimes, when attempts have been made to avoid amputation in the first instance, it has been ultimately rendered indispensable by extensive suppuration, or by destruction of portions of the bones keeping up constant irritation in the system, or by gangrene of the foot. When this last condition occurs, it is desirable to have the limits of the grangrene fixed before the operation be attempted ; although it is not so absolutely indispensable to have limits set in gangrene arising from destruction of vessels in a healthy person as in gangrene arising from a constitutional cause.

The principles by which we should be guided in regard to time and place for amputation in cases of gangrene after injury, were stated, when treating of the different varieties of gangrene, in the first chapter of this work.

DISLOCATION OF THE ASTRAGALUS.

For making clear the description of all the dislocations connected with the astragalus, they may be arranged into three classes :—In the first, there is a change in the relations of the astragalus to the bones of the leg ; in the second, to the bones of the tarsus with which it articulates, namely, the calcaneum below and the os scaphoides in front ; and in the third, both to the bones of the leg, and to the above-mentioned bones of the tarsus. The first class comprehends the injuries usually called the dislocations of the ankle joint, which we have already endeavoured to explain. The second class may be said to consist of accidents in which the bones of the leg, and along with them the astragalus, are displaced from their natural relations to the foot. The tibia and fibula, instead of being sent away from the astragalus, as in the dislocations of the ankle joint, retain their connexion with that bone, and carry it along with them from its natural relations to the calcaneum and scaphoid bone. The dislocations of this class, like those of the ankle, are five in number, and like them are named, inwards, outwards, partial dislocation forwards, complete dislocation forwards, and dislocation backwards. They are easily recognised by the appearance of the deformity, and they are reduced without much difficulty by extension and counter-extension, and pressing the leg and foot in opposite directions, so as to bring them into their proper relations to each other. These dislocations, like those of the ankle, may be simple or compound. The third class comprehends dislocations in which there is displacement of the astragalus from the bones with which it is related, above, below, and in front. These dislocations may be partial or complete, and simple or compound. In complete dislocation there is perfect disruption of the astragalus, the tibia coming into contact with the calcaneum, resting upon it, and firmly pressed against it by the action of the powerful muscles of the leg. These injuries are of a very serious character ; they occur only in consequence of great violence ; they are very easy of detection, but extremely difficult of reduction ; indeed, in some cases, reduction has been found impossible, without division of the tendo Achillis, but after tenotomy, reduction has been accomplished without difficulty. The diagnosis is rendered easy by the history of the case—the swelling caused by the astragalus, the appearance of the deformity, and in the complete dislocation by the singular aspect on the side of the foot caused by the points of the malleoli descending almost to the sole of the foot. The dislocations which have been met with are forwards, forwards and inwards, forwards and outwards, inwards, outwards, backwards, and backwards and inwards. Some have doubted the occurrence of dislocating inwards and outwards, and have supposed that cases believed to be dislocations inwards and outwards, must have been forwards and inwards, and forwards and outwards. I have seen two cases of dislocation inwards and one of dislocation outwards, and in these cases there could be no question whatever, the astragalus was not sent forwards. Cases have come under my own observation of dislocation forwards and inwards, and forwards and outwards, but I saw no risk whatever of confounding them with cases in which the displacement of the astragalus exhibited the lateral character alone. In the lateral dislocations there was fracture of the tibia or fibula in each case. These dislocations are the results of the momentum of the body being impinged with great force upon

Fig. 126.



the astragalus, generally in severe falls; and the direction in which the astragalus is sent off the calcaneum seems to depend on the attitude of the foot at the time the astragalus receives the whole momentum of the body from the bend of the tibia. The attitude of the foot determines the direction in which the force acts upon the astragalus. If the foot be extended, the dislocation will, in all probability, be forwards; if extended and twisted outwards, it will be forwards and inwards; if extended and twisted inwards, it will be forwards and outwards; if twisted inwards, it will be outwards; if twisted outwards, it will be inwards; if bent, it will be backwards; and if bent and twisted outwards, it will be backwards and inwards.

Treatment.—If the case be not so bad as to render it useless to make an attempt to save the foot, the patient should be brought under the influence of chloroform, the foot and leg should be separated as much as possible from each other by extension and counter-extension, and every effort made to replace the astragalus. If unsuccessful, the tendo Achillis should be divided by subcutaneous section, and on renewing the proceeding, the desired result will, in all probability, be obtained. It is surprising what recoveries are sometimes made in such cases. In a case which came under my own observation, the astragalus was completely dislocated forwards and outwards, the dislocation was compound, and the bone was the subject of comminuted fracture. I removed the bone, and the tibia was in contact with the calcaneum. The patient made an excellent recovery with a stiff joint, but a very serviceable foot. Reduction should be accomplished when possible and proper; the bone should be removed when so injured as to afford no hope of its being possible to preserve it with advantage to the patient, and a stiff joint formed by the tibia and calcaneum; and in extreme cases of complication and very extensive destruction of parts, primary amputation is justifiable. The importance of preserving a foot with many and great imperfections, and the by no means encouraging results of primary amputation, along with other considerations, will prevent the surgeon from risking the removal of a foot which could by any means be preserved with advantage to the patient. The many admirable appliances for preserving the parts at rest and in a proper position, furnish great assistance in the treatment of these cases. The cases of dislocation of the astragalus by Phillips, Cross, Lee, Lonsdale, Campbell, De Morgan, Butcher, Williams, and others, are exceedingly instructive, and well deserving of careful perusal.

CHAPTER XI.

AFFECTIONS OF THE OSSEOUS SYSTEM.

PERIOSTITIS.

SIR PHILIP CRAMPTON, of Dublin, who first gave this name to inflammation of the periosteum, has the merit of being the first person who gave a description of that form of the disease which proceeds from cold or external injury, and is called idiopathic, to distinguish it from the symptomatic form, which is the effect of scrofula, syphilis, or the injudicious use of mercury. Professor Graves of Dublin, in his excellent "Clinical Lectures," divides this disease into two forms,—the diffused and the circumscribed; the former corresponding with the idiopathic, the latter with the symptomatic of Sir Philip Crampton.

Periostitis may be either acute or chronic. When it occurs in a person of sound constitution, and is occasioned by cold or external injury, it is usually acute; when it is of the symptomatic or circumscribed form, it is generally chronic; and when it is excited by external causes in a person predisposed to the disease by scrofula, syphilis, or the too free use of mercury, it often exhibits both the acute and the chronic form.

Causes.—The causes of periostitis may be divided into exciting and predisposing. Of idiopathic periostitis the exciting causes are atmospheric influence and mechanical injury; the predisposing causes, a feeble, debilitated state of the body, induced by mental anxiety, or long-continued derangement of the digestive apparatus. Of symptomatic periostitis, the exciting causes—although this form of the disease sometimes occurs without any known exciting cause—are the same as those of the idiopathic form. The predisposing causes are scrofula, syphilis, or an irritable condition of the constitution caused by the prejudicial use of mercury. If in any unfortunate person, the subject of an attack of periostitis, "the triumvirate of scrofula, syphilis, and mercury," as an excellent writer has expressed himself, should chance to meet, the symptomatic form will be, in all probability, of the very worst kind. The causes may be therefore termed the external or exciting, and the internal or predisposing.

Periostitis is most common in bones situated near the surface of the body, as the cranium, clavicle, sternum, and tibia: the pericranium over the frontal bone, on account of its exposed situation, is frequently the subject of the disease; sometimes also the periosteum of the humerus is attacked by it, and occasionally that of the femur.

Symptoms.—The symptoms in some degree differ according as the disease is of the acute or chronic form. We shall, however, consider the symptoms of both forms together, noticing the differences as we proceed.

Deep-seated pain is one of the earliest and most urgent symptoms. It is severe on account of the unyielding nature of the tissue affected, and is of a girding nature, and in some conditions attended with throbbing. In acute periostitis it is constant, and, like the pain caused by inflammation of most hard tissues, is characterized by remissions and periodical exacerbations; the exacerbations occurring during the night, when the pain is often most excruciating. In the chronic form, the pain is so much diminished during the day as to be intermittent; but the nocturnal exacerbations are particularly distressing.

Together with pain, there is *extreme tenderness on pressure*, sometimes amounting even to intolerance of touch. This symptom is much greater in periostitis than in ostitis.

Swelling is, comparatively speaking, an early symptom, and is also subject to variety during the different stages of the disease. In the first stage, the swelling is of an elastic, tense, doughy feeling, dependent on the swollen condition of the periosteum itself; it may afterwards become œdematous, from effusion into the cellular tissue external to the periosteum, but there is always the elastic feeling underneath this œdema. The ultimate character, however, of the swelling varies, both as to hardness and extent, according as the periostitis is acute or chronic. The varieties and conditions on which they depend will be understood from the description of the state of the parts given in another page. In the chronic form, the swelling, at first elastic, often becomes ultimately quite hard; but it is only in this form, and after long continuance of it, that we find, on pressing it firmly with the fingers, that rigid, incompressible hardness which characterizes swelling of the bone itself. The skin is at first pale, and not involved in the disease; but if the disease be acute, the swelling, sooner or later, becomes diffuse, and the skin red, tense, tender, and glistening.

Constitutional Symptoms.—Periostitis is accompanied with evident constitutional symptoms. In the acute form they are the same as those of inflammatory fever, but of a more aggravated character, and attended with great derangement of the digestive apparatus. In the chronic form the patient becomes pallid, weak, relaxed, and emaciated, from continued irritation and want of sleep, and exhibits the symptoms of hectic fever. In short, the accompanying fever is of the inflammatory type in acute, and ere long becomes of the hectic type in chronic, periostitis. There is, however, one condition of the acute form of the disease in which the inflammatory fever, which attends the very commencement, is speedily converted into hectic fever: namely, when suppuration takes place to a great extent.

State of the parts.—One of the earliest pathological changes is increased vascularity of the periosteum. In the acute form the periosteum is thickened and softened; while in the chronic it is thickened, and its density increased. Sometimes it is thickened without effusion under it; and then there may be increased adhesion of the periosteum to the bone, with increased vascularity of the bone; and this, if not relieved, may, after considerable suffering and derangement of the general health, terminate in the conversion of the periosteum into a fibro-cartilaginous substance. This is usually attended at last with some swelling of the bone itself. If there be no subsidence of the inflammation in periostitis, effusion may take place both inside and outside the periosteum; effusion of serous fluid into the surrounding cellular tissue giving rise to œdema, and secretion of fibrin taking place underneath the periosteum between it and the bone. The secretion of fibrin under the periosteum is more likely to take place in the chronic form, and is termed by some the gelatinous effusion. "The bone," Liston observes, "is imbedded in a gelatinous or lymphatic effusion situated mostly beneath the periosteum." Inflammatory or recent node is the name distinguishing this raised condition of the periosteum caused by the effusion of lymph; and if the inflammation does not go on to a more acute stage, the effusion may be converted into cartilage, and then into bone forming permanent node. Other products of inflammation may be formed in the acute variety: if the inflammation be great, purulent matter may be formed between the periosteum and the bone, causing separation of the periosteum. Sometimes the separation is extensive, and necrosis of the bone from inflammation, and from the loss of its nutritive membrane, may be the result. It is when the suppuration is extensive and takes place very speedily, that the inflammatory fever which attends the very beginning of the disease may be so quickly converted into the hectic type. There is a form of periostitis termed by some paronychia periostei, or the deep-seated paronychia, or whitlow, and by others the paronychia maligna. This is an example of severe acute periostitis, and affects the phalanges of the fingers and their periosteum. In this variety the pain of the finger is excessive; it feels as if it would burst; there is great œdema and swelling of the hand, and often the whole finger appears as if affected with erysipelatous inflammation. Suppuration to a considerable extent, sloughing of the soft parts, and destruction of some of the bones are sometimes consequences of this form of periostitis.

Treatment.—The mode of treatment differs in the acute and chronic forms.

In the acute form, the constitutional treatment consists of low diet, antimonials, saline purgatives, diaphoretic medicines, and such means as are capable of procuring resolution. The local treatment includes quiet, an attitude favourable to the reflux of the venous blood, leeches, warm and emollient applications, as fomentations, poultices, and other antiphlogistic means. Free division of the periosteum should be employed, according to some, only when other treatment has failed. Miller objects to free direct division if suppuration be not present, and recommends a valvular division of the inflamed periosteum. Syme says, "The mode of treatment depends upon the intensity of the symptoms. When they are very violent and attended with smart fever, the most effectual practice is to make a free incision through the inflamed parts down to the bone. When less severe, no benefit is derived from this proceeding."

"Free incisions," says Liston, "through the periosteum sometimes relieve the pain, and cut short the disease, the distended vessels being thereby emptied; but such practice is only a last resource, when the action has resisted all other means and threatens an unfavourable termination." If, in the acute form, the inflammation proceeds to suppuration, free division is the more necessary. But whether suppuration be present or not, the distended vessels ought to be relieved by early free direct incision. By early adoption of this proceeding, suffering is lessened, and structure saved; and by its neglect or delay, as, for example, in respect to the fingers, important parts are lost.

In the chronic form, the constitutional treatment consists in the exhibition of internal alterative remedies, as hydriodate of potass, which, to prove efficacious, must be administered in pretty large quantities, say of about ten grains in divided doses during the day. It may be given in water, or combined with sarsaparilla, which is itself an excellent alterative. Some authors deprecate the employment of powerful alteratives, unless all others have failed. Mercurial alteratives are found exceedingly useful in relieving chronic periostitis, and should be tried, if the body be not exceedingly irritable, and if the above treatment have not had the desired effect. It seems strange that mercury, a predisposing cause of periostitis, should prove a remedy; yet that it does so is an ascertained fact. Bichloride of mercury answers well, and may be given in doses of a tenth of a grain twice or thrice a day, either made into a pill, or in solution in sarsaparilla. "General chronic periostitis, which is produced by exposure to cold, or occurs often during mercurial courses, and is often supposed to be a symptom of syphilis, is relieved by the internal exhibition of bichloride of mercury, or other mercurial preparations, combined with sarsaparilla and diaphoretics. In many instances such an affection will yield to no other treatment; and thus the practitioner is occasionally obliged to have recourse to a somewhat paradoxical practice, that of giving mercury for a disease which seems to have been produced by that mineral."

Local treatment comprises the use of some of the different forms of counter-irritants. Blisters are sometimes very useful; and in some cases the local application of an alterative, as mercurial ointment rubbed into the part, or painting it frequently with tincture of iodine, may be found beneficial.

NEURALGIA PERIOSTEI.

This very painful affection sometimes follows amputations, or slight injuries of a bone; sometimes it affects the periosteum of the ribs and sternum in cases of spinal irritation or uterine derangement, when a morbid sensibility in the sentient extremities of nerves is by no means an unusual condition; and sometimes it comes on without any known exciting cause. The disease generally affects females of weak constitution, though males of an irritable habit are also subject to it. I have met with many examples of this affection in females of a hysterical habit; and two I have seen in males, one, of the periosteum of the ribs in a young man who died of phthisis, and the other, of the periosteum of the humerus in a gentleman who never had any complaint beyond derangement of the digestive apparatus, and neuralgic pains about the face.

Symptoms.—One of the earliest and most urgent symptoms is severe pain, of a sharp neuralgic kind, sometimes so severe as to deprive the patient of sleep; and like all neuralgic pains, intermitting, and often recurring periodically. Extreme tenderness on pressure is often a symptom, and in some cases, the nervous sensibility is so acute, that the slightest touch is painful. Sometimes, but not always, this tenderness to touch extends to the common integument. In the example of the affection which I met with in the periosteum covering the ribs, the integuments could be pinched up and pressure directed against the intercostal spaces without causing any uneasiness; but the slightest pressure directed against the ribs occasioned great pain. Mr. Wells, in an excellent article on diseases of the bones, states that he met with two examples of this affection of the periosteum covering the ribs in two young men who had fallen into phthisis after syphilis and the too free use of mercury; and in both these instances the pain on pressure was entirely confined to the periosteum. The only opportunity I have had of examining the periosteum after death, was in the case of phthisis above referred to. There was not the slightest trace of inflammation, nor any apparent change in either the periosteum or the bone. There have been many cases in which persons who have suffered from this affection have been examined after death arising from other causes, without the surgeon having been able to detect any trace of vascular hyperhæmia. The conclusion drawn from hence is, that neuralgia periostei depends upon a painfully increased sensibility of the sentient nerves of the periosteum.

Treatment.—This disease must be combated by general and local treatment. The object aimed at by general treatment is to give increased tone and strength to the system, and the means to be used for this purpose must be suited to the particular state of the patient. Exercise and free exposure in the open air, a generous diet, and the due regulation of the bowels, together with tonics, such as preparations of iron, and more particularly the carbonate and the saccharated carbonate of iron, are prescribed with advantage, when the patient is not suffering from any other disease, and when no symptoms appear indicating that their employment would be prejudicial. As local applications, different anodyne liniments, and plasters containing opium or belladonna, or both, are useful. I have often prescribed, apparently with advantage, a liniment of equal parts of the tincture of belladonna and the tincture of opium, to be kept constantly over the part; and I have seen plasters containing large quantities of belladonna or opium, or both, very serviceable; liniments and plasters containing aconite are also very useful. The above are the only local applications of which I have had any experience, with the exception of the endermoid application of nitrate of silver, which I have known to prove exceedingly useful.

OSTITIS.

Ostitis is the name given to inflammation of bone. It may arise from cold, external injury, periostitis, or neglected or improperly treated phlegmonous erysipelas :—in the latter case, the inflammation spreads from the soft parts to the periosteum and bone, so that they become secondarily affected. It is also often induced by inflammation of the synovial membrane at the extremity of a bone. These may be called the external and exciting causes; and when they induce the disease in a person of sound constitution, it is then said to be *simple* ostitis; but when the constitution of the patient has been previously affected by scrofula, syphilis, or mercury, which are predisposing causes, the diseased action is then modified by the general state of the system, and the ostitis is termed *specific*. It is of importance to understand how far the inflammation of the specific forms can be distinguished from that of the simple by their effects, and to ascertain as far as they are known the characteristic appearances of each. Ostitis may not only be either simple or specific, but also, like other inflammations, either acute or chronic.

Symptoms.—In the acute form, one of the earliest symptoms is deep-seated agonizing pain, which by the patient is referred to the bone. The pain is even more excruciating than in periostitis, and is of a bursting kind. It is less aggravated by pressure than in periostitis, and, as in that disease, it has nocturnal exacerbations. In the acute forms there are occasional remissions of the pain, but in the chronic form there are often complete intermissions. The pain is increased by motion of the limb, and by the dependent posture. In ostitis, tenderness to the touch at first is slight; in periostitis it is the reverse, so that this symptom is diagnostic at an early stage of the disease; but afterwards the periosteum becomes inflamed, and then there is the same acute tenderness as when that membrane is primarily affected. Swelling is long of making its appearance; and when it does, it is for some time hard, solid, and diffused; afterwards it becomes œdematous from effusion into the cellular tissue, and the soft tissues over the bone at last present the ordinary local symptoms of inflammation. The constitutional symptoms are those of inflammatory fever; and their violence will depend on the intensity, extent, and duration of the disease, and the susceptibility of the constitution to sympathize with the local action.

In the chronic form, pain is the earliest symptom. Compared, however, with the pain in the acute form, it is inconsiderable; and while it has distinct exacerbations during the night, it is always marked by decided remissions, and often by complete intermissions during the day:—this is for a long time the only local symptom. Swelling is long of making its appearance, and when it does, it is much more circumscribed than in the acute form, and is characterized by an unyielding incompressible hardness. If the periosteum become affected, the swelling will at last present the character of the same symptom in chronic periostitis; but it is slower in its progess, and longer in making its appearance, than in that disease. In the early stage, pressure has little or no effect in aggravating the pain, and it is often a long time before the patient complains of tenderness when the bone is pressed. There is very little sympathetic effect produced in other parts of the system until the disease has been of long standing; and when the continuance of the nocturnal exacerbations and want of rest cause constitutional disturbance, the fever is of the hectic type.

State of the parts.—The changes produced in the osseous structure, by acute inflammation, during the period of its activity, and before reaching suppuration, whether external, internal, or general, simple or carious ulceration, or some of the different forms of necrosis, are but imperfectly known. The blood-vessels have been found more numerous and distended than natural. The bone becomes softened, apparently from absorption of part of its earthy matter, its cancellated texture appears unusually open, the lamellæ are thinned, and the haversian canals become preternaturally large, as if the distended vessels pressed aside the softened structure. This last-mentioned conditions sometimes gives the bone, especially on the surface, a porous appearance. Exudation of a sero-sanguineous fluid takes place both into the cells and into the haversian canals. Such are the principal conditions produced, in the first instance, by acute inflammation in a bone not the subject of any previous unhealthy deposit. After some time, the following changes may take place in acute ostitis. The inflammation may result in resolution, or in one of the varieties of suppuration, which will afterwards be described; or it may lead to simple or carious ulceration, or to necrosis. If the inflammation be of a more chronic character, other changes may take place. Sometimes the bone becomes expanded or enlarged, and, at the same time, especially in syphilitic patients, consolidated, and its weight increased. These changes, caused by the plastic exudation passing into bone, may either affect the entire bone, or be confined to a particular region of it, which has been more especially the subject of inflammation. This osseous formation taking place upon the inner surface of the haversian canals, their cavities become more or less filled up, so that in many cases a section of the diseased part presents a nearly uniform ivory-like texture, in which few orifices appear. Sometimes these deposits are in the cavities of the long bones, making them almost solid throughout; and often, they are found on the surface, occasioning protuberances, rendering the bone rough or uneven, and considerably altering its figure and appearance. In scrofulous subjects the bone becomes very much lighter than natural, and is filled with a cheese-like substance. In some specimens in my collection, this substance occupies only part of a bone; in others it extends through almost the whole of a bone, occupying nearly the entire space within the shell, which is exceedingly thin, and in these instances the whole of the earthy matter is absorbed, except that which forms the very thin external shell. In other specimens, this peculiar deposit is equally extended through the whole of a bone, but seems to be diffused through the cancellated structure, which is not entirely absorbed. In some of the specimens, where this substance is general through the whole of a bone, and where the shell is very thin, there are small deposits of bone, forming osseous irregularities, or spicula, on the external surface. The colour of this substance is in some cases pure white, in some yellowish-white, and in others reddish-brown. In many cases traces of inflammation accompany this cheese-like deposit, while in others no such traces are apparent. It may result from previous perversion of nutrition, unattended with inflammation; or it may be a transformation of the liquor sanguinis exuded in consequence of a low grade of the inflammatory process in a person of scrofulous diathesis. The subject of such deposits will be more particularly referred to in the description of tubercle in the chapter on Tumours.

Treatment.—This may be summed up in a very few words. It is both general and local. In the acute form the treatment is precisely the same as in periostitis, except that there is no necessity for incision. In all cases the treatment should be decided, that the inflammation may, if possible, be prevented from going on to suppuration or caries. The local and general depletion, however, must not be carried to too great an extent, as the consequent debility predisposes to caries. In the chronic form, the treatment consists locally, in the employment of the different counter-irritants; and internally, of the alterative remedies recommended in the treatment of periostitis; but it should be remembered that mercury, although often useful, ought to be exhibited with the greatest caution, as the interstitial absorption arising from the free use of this medicine, in some forms of ostitis, increases the danger of the occurrence of caries.

SUPPURATION IN BONE.

Suppuration may be divided into three varieties—namely, external, internal, and general.

Of external suppuration, there are two kinds, acute and chronic; each presenting a different assemblage of symptoms, and requiring different treatment.

Acute External Suppuration, or acute external abscess, is a frequent consequence of periostitis, or ostitis, or both.

Symptoms.—Pain of an excruciating kind, attended with the other symptoms of ostitis, if that be the cause of the disease—rigors, recurring at intervals, and swelling, which has a feeling of fluctuation. The integuments ultimately present the local symptoms of inflammation. Absorption, ulceration, caries, and even necrosis of the bone may be produced, if the purulent matter which burrows beneath the periosteum be not speedily evacuated.

Treatment.—Before the abscess is formed, the surgeon should endeavour to remove the inflammatory action by the usual antiphlogistic remedies; but after its formation the appropriate treatment is free, direct incision, which affords very great relief to the patient.

Chronic External Suppuration, or chronic external abscess, may be the consequence of an attack of chronic inflammation, which may have commenced in the bone, or in the periosteum, or in both of these tissues.

Symptoms.—These at first are the same as the symptoms of chronic periostitis, or chronic ostitis, or of both these diseases. After some time a swelling with fluctuation forms, unattended with the symptoms of acute inflammation. The swelling is generally small and circumscribed, just the reverse of what takes place in chronic abscess of the soft parts.

Treatment.—The treatment proper to be first tried is the same as in small chronic abscess of the soft tissues; accordingly all means likely to produce absorption should be employed. With this view it is necessary to improve the general health, and to enjoin dry and solid food, and abstinence from liquids; in addition to which, internal alterative remedies, as iodide of potassium, should be given in small quantities,—four or five grains in solution, in divided doses, during the day, will often be found beneficial. The local treatment consists in the employment of various applications used to promote absorption. For this purpose it has, in many instances, been found advantageous to paint the part with the tincture of iodine, as frequently as the state of the skin will permit. A lotion of iodide of potassium, iodine, and water, of the proportions of ʒii of the iodide of potassium, ʒi of iodine, and ℥i of water, is sometimes used in the same manner as the tincture, and with good effect. Some apply blisters, from their well-known effect of sometimes promoting absorption; others in using them dress the part with mercurial ointment. If these means do not effect a cure, a small *valvular* incision is necessary. If, through improper treatment, the chronic is converted into an acute abscess, free *direct* incision must be employed. Friction sometimes changes a chronic into an acute abscess. It sometimes happens, in unhealthy constitutions, that, after injuries or amputations, very extensive collections of pus take place under the periosteum; and in some forms of phlebitis collections of purulent matter form, without being preceded by accident or amputation: sometimes they happen as sequelæ of fever. They almost always prove fatal; yet, if the patient be healthy, he may recover after necrosis of the bone.

INTERNAL SUPPURATION.

Of this there are four varieties:—namely, diffuse, acute, internal suppuration; limited acute, internal suppuration; chronic internal suppuration; and scrofulous, tubercular abscess of bone.

I. DIFFUSE ACUTE INTERNAL SUPPURATION.

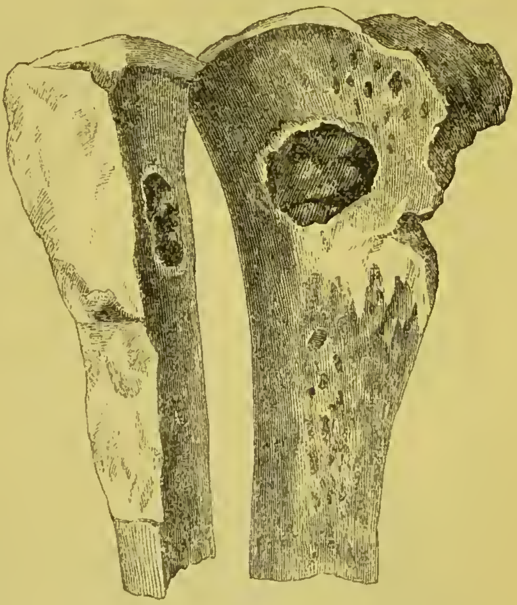
Diffuse acute internal suppuration, being a result of acute ostitis, is preceded by the local and constitutional symptoms of inflammation of bone, and both sets of symptoms are usually of an extremely urgent character. It is sometimes evidently the result of internal causes, as when a constitutional affection fixes itself in a bone; and it sometimes arises from external causes, as cold or bruise, without a wound; but more frequently it occurs in consequence of compound fracture, or of amputation, or of injury of bone in operation. It is well known that the occurrence of this condition is one of the frequent causes of death after operations in which the medullary canals of bones are laid open, or the deploë of skull interfered with, and that it leads to death by phlebitis and pyemia, purulent and sanious matter being formed in, and finding their way into, the veins of the bones, and from thence into the general circulation. The medullary membrane is primarily affected with inflammation of a diffuse character, and, as Stanley remarks, becomes vascular and swollen like the conjunction in chemosis, and not unfrequently black and gangrenous. The cancellous structure becomes involved, and infiltration of matter takes place into the medullary canal, into the cells of the cancellous structure, into the Haversian canals, and, in short, into all the parts affected by the inflammation. If the patient do not sink under the disease, in consequence of phlebitis and pyemia, rigors and hectic fever supervene. The purulent matter destroys the cancellated structure, and some parts of the bone become very much absorbed. The canals for the transmission of vessels become enlarged, and through them and the apertures formed by the absorption of portions of the bone, the matter makes its way to the surface, and, in cases that may be considered as comparatively favourable, sooner or later there is an indistinct undulation or fluctuation beneath the periosteum and the superimposed soft tissues which become involved.

Treatment.—This is at first the same as in acute ostitis, and should be as decided as the circumstances of the case will admit. As soon as fluctuation is present, recourse must be had to free direct incisions. When hectic fever supervenes, the treatment must be tonic.

II. LIMITED ACUTE INTERNAL SUPPURATION, OR LIMITED ACUTE INTERNAL ABSCESS.

This usually takes place in the cancellated heads of the long bones, frequently in that of the tibia, sometimes in its shaft, and sometimes in its under extremity, in persons about or beyond the middle period of life, who are exposed to cold and night air.

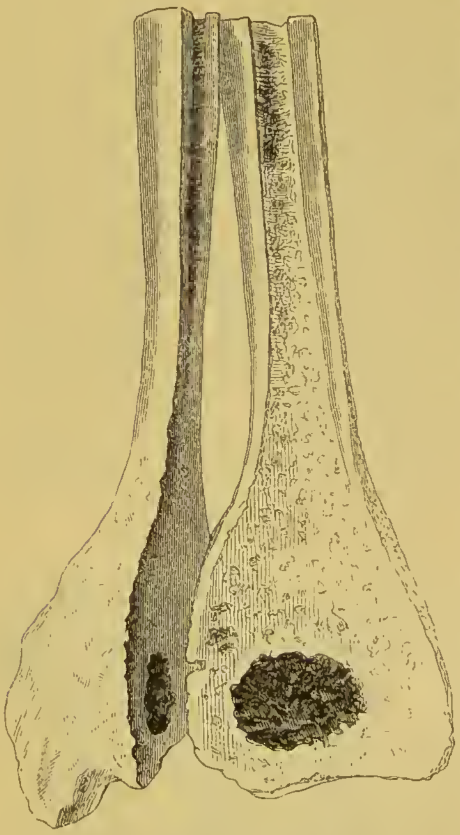
Fig. 127.



Symptoms.—The principal symptom is most excruciating pain. This has been found in some cases to be constant, and in others to be slight, or amounting only to uneasiness during the day, but in all there is liability to severe nocturnal exacerbations. It is referred by the patient to a particular spot, and is attended with a degree of throbbing and a sensation of weight. As the disease advances, tenderness and pain are experienced when pressure is applied to the soft tissues and the part of the bone external to the disease. After some time the skin becomes red and slightly hot, but there is no swelling. The symptoms are aggravated by motion of the limb.

State of the parts.—After the disease is fully formed, on making a section of the bone there is observed a cavity or sac in its interior, having a distinct bony encasement. The interior of the cavity is lined with a vascular membrane, from which the exudation takes place which is transformed into pus. A lower degree of inflammation extends to the textures external to the bony encasement. In the museum of St. George's Hospital, there are several very beautiful and interesting specimens of this disease, from which the accompanying drawings were taken.

Fig. 128.



Treatment. — Sir Benjamin Brodie has the merit of having proposed the proper treatment, which consists in making a crucial incision of the soft parts, exposing the bone, and by means of a trephine sawing out a portion of it, so as to allow of the evacuation of the matter. Sir Benjamin has treated cases successfully in this way; Mr. Liston records a very instructive case, in which the same practice was followed by the desired result; and numerous other cases have been treated with equal success. Figs. 129, 130 represent a case in which the matter made its way to the surface, by its own efforts; but from the firm nature of the new bony encasement which surrounds the matter, this is a result which can seldom be looked for.

Fig. 129.

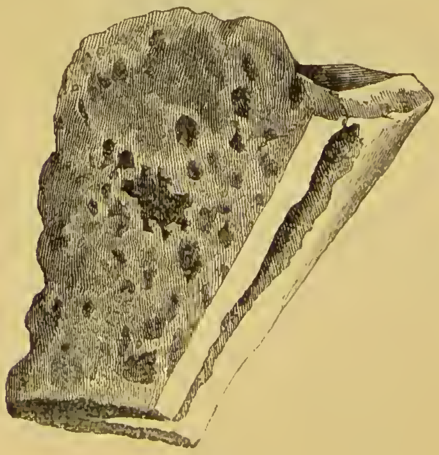
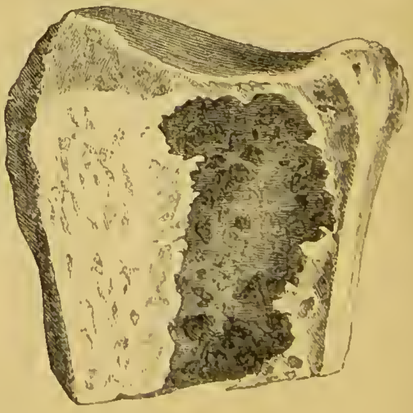


Fig. 130.



III. CHRONIC INTERNAL SUPPURATION, OR CHRONIC INTERNAL ABSCESS.

Symptoms.—These, both local and general, are the same as those of chronic ostitis, although sometimes at first they indicate acute ostitis. Swelling of the bone soon occurs, and if the strength of the patient holds out, so that the disease runs its course, an indistinct undulation or fluctuation, depending upon the thin state of the bone, is at last perceptible to the touch. The constitutional symptoms are ultimately those of hectic fever.

State of the parts.—As the name of the disease indicates, matter is formed, and it is contained in an indistinct cyst. "The result of the pressure of the abscess is to cause an absorption of the cancellated structure, and in this way the space for the increase of the abscess continues to be enlarged." The matter is thin and unhealthy, and is mixed with the debris of the bone. The cancellated tissue of the bone is dilated, and the integuments over the bone become inflamed.

Treatment.—This consists in free direct incision through the soft tissues and the shell of bone, which is, in consequence of disease, generally divisible by a strong scalpel. After the evacuation of the matter, it is advisable to inject sulphate of zinc lotion into the interior of the bone, to employ gentle lateral compression and support, and at the same time to enjoin rest, and adopt judicious measures for supporting the general strength.

IV. SCROFULOUS TUBERCULAR ABSCESS OF BONE.

Symptoms.—This affection which, as the name indicates, is met with in persons of a scrofulous habit, is at first characterized by a sense of weight and uneasiness in the diseased part, not amounting to pain. This sensation is referred to a particular part, and is increased by pressure and by motion, and sometimes by the heat of bed. Enlargement of the osseous tissues takes place, followed by œdematous swelling of the soft parts, and the integument presents a bluish colour. In the suppurative stage the uneasiness is changed into actual pain, and the enlargement increases more rapidly. The matter sometimes makes its way to the surface, in which case a swelling with fluctuation will be perceptible. On being discharged, it presents the ordinary characters of such collections in scrofulous habits; and the cavity has no tendency to heal, but continues to throw out an offensive discharge. Such collections, instead of making their way to the surface, frequently open into the neighbouring articulation; and in that case there is great increase of pain, and of the other local symptoms, together with pretty decided symptoms of irritative fever, which soon change to those of the hectic type. Except when the disease opens into an articulation, it is not accompanied by any strongly marked symptoms of inflammatory fever; but in all cases it sooner or later gives rise to hectic fever.

State of the parts.—The cancellated structure of the bone is the part where tubercular matter is deposited, and its most frequent sites are in the cancellous structure of the long bones, in the bones of the tarsus, and in the bodies of the vertebræ. There are two different forms in which it is deposited,—the encysted and the infiltrated; and each form has distinct varieties. The encysted form presents itself in small masses contained in cyst, and it is sometimes of an opaque white and sometimes of a yellowish colour. The infiltrated variety may be either of a very firm consistence and of a grey semi-transparent appearance, or it may be of an opaque white or bright yellow colour, at first infiltrated into the cancellous structure, and eventually coming to occupy its place. I have collected a great many beautiful specimens of tubercular deposits in bone, and have seen many examples of all the above varieties; but, judging from my own observation, I believe the infiltrated variety the most frequent. The morbid deposit may be the result of previous perversion of nutrition, or the change of liquor sanguinis exuded in consequence either of congestion or of a slight grade of the inflammatory process. The change of the liquor sanguinis into scrofulous or tubercular deposit, is believed to depend on the constitution or inherent composition of the exudation. The constitution is determined by that of the blood; and such being the case, the importance becomes evident of attending to the nature of the food, of promoting the proper performance of the functions of the digestive organs, and of guarding against everything calculated to operate unfavourably on the composition and properties of the blood. In its progress, the disease comes to be accompanied with a degree of inflammation, which proceeds to suppuration.

Treatment.—This local affection is very much influenced by the state of the general health, which therefore requires to be particularly attended to through all its different stages. The formation of the tubercular deposit in the cancellated structure of the bone is the first deviation from its sound condition. The conditions in which that formation is apt to take place is the scrofulous diathesis, together with a weak state of the general health. It is often found in persons of that habit who have been confined to situations where the air is impure, cold, or damp; who have lived on a diet not sufficiently nutritious; who have not enjoyed regular exercise and exposure in the open air; or who have been subjected to any particular cause of debility. If the presence of the deposit be suspected, the endeavour must be made to limit its extent, and to delay the suppuration, by removing the patient from the influences which excite unhealthy secretion. For that purpose, residence in a dry situation, exposure to the light of the sun, sleeping in an airy room, free exposure in the open air, generous diet, and the use of such medicines as from the particular state of the patient are most likely to improve the general health must be strictly enjoined. Tonic medicines, and more especially the preparations of iron, are useful; but as permanent strength can be communicated only by the proper assimilation of nourishment, those remedies should be used which, from the particular state of the patient's health, are most likely to fit the digestive organ for the reception and proper digestion of food. Of all remedies cod liver oil is the most valuable in this, as well as in other scrofulous affections. Limitation of the tubercular deposit, and prevention of suppuration are obviously paramount indications. The principal doctrines in regard to the pathology and treatment of tubercle have already been stated in the chapter on Tubercle. When suppuration does take place, the pain should be mitigated by fomentations and rest of the affected part, and the matter should be evacuated as soon as its presence is detected. Sometimes counter-irritation by means of a blister gives some relief from the pain; but local depletion forms no part of the proper treatment of this affection, as it would only diminish the general strength without helping to remove the local disease.

General Suppuration will be considered when treating of Necrosis.

ABSORPTION OF BONE.

This may take place without any inflammation, and therefore without being accompanied by the formation of purulent matter, or of any secretion caused by inflammation. Of absorption of bone without inflammation there two distinct varieties, namely, the continuous, and the interstitial.

Continuous absorption is the name given to that process by which a portion of bone is completely removed without inflammation. The condition under which this process takes place, is when a bone is subjected to gradual and moderate pressure, without the admission of the air to the compressed part. If there be admission of air to the compressed part, or if the pressure be very severe, inflammation will be induced, and purulent matter formed, and the process by which the bone is removed is then called ulceration. If the pressure be gradual and moderate, and if the air be excluded, the effect of the pressure is to stimulate absorption without inflammation, and the process by which the bone is removed is then called continuous absorption. By this process in some instances, a large excavation is formed in a bone; and in others, the continuity of a bone is so interrupted that it becomes divided into two portions. Examples of this singular change are met with in cases of tumours, aneurism, or chronic abscess. The gradual compression caused by these diseases sometimes produces a depression in a bone, and in some instances, as, for example, in an aneurism within the chest making its way to the surface, portions of some of the ribs are so completely removed that their continuity is entirely interrupted. The only mode of treatment which can stay the progress of continuous absorption, is to remove the exciting cause, by curing the disease from which it arises.

Interstitial absorption may affect either a part or the whole of a bone. In the former case it is indicated by dull uneasiness, or a sense of fatigue, or aching of the part, increased very soon to actual pain on exercise; by slight œdema of the superimposed soft parts, which is also increased by exercise; by lividity from passive congestion, and sometimes also by coldness of the integument. This form of interstitial absorption often occurs in the tarsus and metatarsus, and in the carpus and metacarpus, and frequently terminates in caries. In this disease the laminated portion of a bone is converted into cancellated texture, and the walls of the cells become thinner, so that the cells appear very large. The surface of the bone also presents a very porous appearance. The treatment consists in attention to every measure likely to improve the general health, combined with rest of the part affected, and the constant use of gentle counter-irritation, while the symptoms continue. After the removal of the local symptoms, gentle support of the part is often found to be grateful to the feelings of the patient.

Interstitial absorption affecting the whole of a bone is often met with in diseases which affect the articular extremities of the long bones. There is a wasting and absorption of the bone as well as of the other tissues of the limb. To such an extent does this absorption sometimes take place, that the shell of the bone becomes extremely thin, and the cancellated structure uncommonly open, so as to present the appearance of large cells with very thin walls, and in some parts the cancellated structure is entirely removed.

The removal of the local disease which is the exciting cause of this affection, and the improvement of the general health together with the restoration of the limb to the performance of its usual movements, are the only means by which the unnatural absorption can be checked, and the healthy communication of nutrition to the bone restored.

ULCERATION OF BONE, OR THE SIMPLE AND TRACTABLE ULCER OF BONE.

Some writers use the term ulceration and caries synonymously. By ulceration we mean that condition of bone in which there is loss of substance, together with suppuration, but in which the ulcer has a tendency to heal. In caries, on the contrary, while there is loss of substance, together with suppuration, there is so far from being any tendency to heal, that healing is very difficult to accomplish. This difference as to the tendency to heal depends on the different conditions of the bone at the surface of the affected part. Liston observes, "It may tend to prevent confusion of the two different morbid states, if we confine the term ulceration to suppuration in and absorption of bone, whilst the vessels retain a considerable power of action, throw out new matter, and procure a reparation of the breach; and this condition of the osseous tissue exists when the disease is situated on the surface of the bone, and when it has been produced by an external cause. On the contrary, the term caries will denote that particular kind of ulceration in which reparation is hardly attempted by nature, and is with difficulty obtained by the most active interference; and this disease will be most generally found to affect the cancellated structure."

Ulceration is caused by pressure, combined with inflammation. In a portion of bone, excluded from the air, pressure alone, unless carried to such an extent as to excite inflammation, is not sufficient to produce ulceration, but may cause continuous absorption. Some writers therefore say, that pressure is the predisposing, and inflammation the exciting cause. Pressure may be either external or internal: examples of the latter are furnished by suppurative ostitis taking place within a bone, when the matter may make its way to the surface by ulceration; and of the former many examples are met with, of which one of the most frequent is, pressure on the surface of the bone by collections of matter forming in consequence of inflammation of the superimposed soft tissues in the vicinity.

Ulceration of bone is characterized by an ulcer of healthy appearance. Examination with the probe is sufficient to show the nature of the disease. The bone itself, which supports the ulcerated portion, is not diseased, differing in this respect from the state of the bone in caries; for while there is in each disease the removal of part of a bone in consequence of inflammation, in a state of simple ulceration the portion of bone forming the surface of the part retains its natural compactness and firmness; but the portion forming the surface of a carious part, and to some depth below, is in a state of interstitial absorption. The action of the vessels is, consequently, very much weaker in the latter case than in the former, and hence arises the difference, as regards the tendency to heal, between the two diseases, which in other respects are very similar. Simple ulcer of bone is healed by the bone forming granulations, which, though soft at first, are soon converted by the deposition of earthy matter into bone. By these granulations the surface is to a certain extent elevated, and the edges of the ulcer lowered by a process of absorption, so that the parts are brought nearly to a level with each other. Owing to the inelastic nature of the bone, the chasm cannot be diminished by the centripetal movement, as in an ulcer of the soft parts; but it is brought nearly to a level, as has just been described, by the rounding off by absorption of the edges, and the filling up of the centre by osseous granulations. The soft parts coalesce with the granulations, and a fibrous membrane is formed over the latter, on which a cicatrix, having a depressed, white, and firm appearance, is at last developed. This is the appearance of the cicatrix when the ulcer of the bone is perfectly healed, and the cicatrix adheres to the bone; but occasionally a cicatrix is formed before the bone has healed, and then it does not adhere to the bone, but is elevated, livid, soft, and painful, and is usually soon destroyed, exposing again the ulcer of the bone.

Treatment.—The constitutional treatment consists in the use of all prudent means for improving the general health, and maintaining the strength, so as to promote the energy of repair; and the local, in the removal of the exciting cause and the employment of rest, a proper attitude, simple water dressings, or medicated, if it be necessary to stimulate, together with gentle support by bandages.

CARIES.

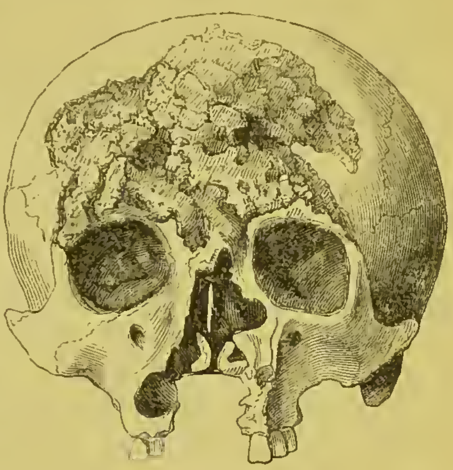
Caries is derived from κείρω, to abrade, and is employed to denote a particular disease of bone. The terms, caries and necrosis, were by the old writers used indiscriminately, although they are two separate and distinct diseases. In caries, part of a bone is removed by the action of the absorbents causing a chasm; in necrosis, part of a bone completely dies: in caries there is very little, in necrosis a very great, effort of nature to form new bone.

"The points of resemblance," Professor S. Cooper writes, "between caries of bone and ulceration of the soft parts are striking; each affection is preceded by inflammation; each is attended with the formation of matter; each may be followed by the production of granulations; each may arise from local or constitutional causes; and each may be combined with the total extinction of vitality in certain points of the textures affected. Thus precisely in the same way as we often see ulceration and sloughing exhibited together in the soft parts, we also frequently find caries and necrosis prevailing together in the bones. Some portions of the osseous texture seem to perish and to be detached from the living parts of the bone, while in other places caries is making its attack and producing its usual effects." Caries generally affects the spongy extremities of the long bones, especially the ends of the femur and tibia, the bodies of the vertebræ, the bones of the tarsus and carpus, the sacrum, the sternum, the patella, the lower jaw, and occasionally the bones of the cranium. Necrosis, on the contrary, attacks the compact, lamellated, or firm tissue of bone. Sometimes, though rarely, caries does present itself in the lamellated tissue of bone; but before this takes place, the bone loses its compact appearance.

Causes.—These may be divided into external and internal. The principal external causes are a violent blow, or a wound, and more especially if it be combined with a bruise, as in a gun-shot wound affecting a bone, atmospheric changes, extensive injury of the periosteum, continued pressure by long maintenance of one position (as in a tedious illness, or fever, when caries of the sacrum is apt to take place, or of the trochanter major of the femur, or sometimes of both), suppuration or ulceration of the soft parts in the neighbourhood, or, in short, any external injury or condition capable of exciting inflammation and ulceration of bone.

The principal internal causes are certain states of constitution, and more especially that condition which we denominate scrofulous, that which is the consequence of infection from the venereal poison, and that which results from the free or injudicious use of mercury. These conditions of system may be considered predisposing causes; but they seem also capable of acting both as predisposing and exciting causes; at all events, when any of them have produced the predisposition, caries makes its appearance from very slight external causes, and in many instances without any known exciting cause at all. The worst forms of caries are those which take place when all the above conditions meet together; that is, in a scrofulous person infected with syphilis, whose constitution has been affected by mercury. Other internal causes, predisposing to caries, though not so powerfully, are the conditions of constitution which exist in scurvy, rheumatism, and gout. Scrofulous caries, syphilitic caries, scorbutic caries, rheumatic caries, and arthritic caries, are names by which some of the above-mentioned forms of this disease are distinguished. The various forms of caries differ from each other as to the parts of bones in which they are most frequently found. Scrofulous caries, the most frequent form of all, usually attacks the spongy texture of bones, as the bodies of the vertebræ, the spongy extremities of the long bones, and the tarsal and carpal bones, beginning in these parts by the deposition of tubercular matter in their cancellated structure; which deposition is succeeded by inflammation, ending ultimately in caries. Syphilitic caries, which is the next in frequency, attacks the compact parts of the bony structure, such as the dense or hard part of the tibia, the compact part of the ulna, and the bones of the cranium. The rheumatic, like the scrofulous, is most frequently met with at the joint ends of the long bones; but it arises from inflammation of the ligaments and synovial membrane, extending sometimes to the articular surface itself. The arthritic, like the rheumatic, takes place in the region of the joints, but seems to prefer the external surface

Fig. 131.



Caries of bones of cranium and face, producing free communication between the mouth, nose, orbits, frontal sinuses, and cranium. Disease commenced by ulceration of soft palate with tubercular syphilitic eruption. From the history it appears that the patient had been subjected to the injudicious use of mercury. From a preparation in my museum.

of the bone, and is generally preceded by a kind of exostosis in which the caries take place, and by the formation of arthritic concretions in the neighbourhood.

Phlegmonous erysipelas, suppression of customary discharges, and the sudden repelling of profuse eruptions of the skin, have been known to cause caries.

Symptoms.—Caries being a result of inflammation, is preceded by ostitis, either acute or chronic, the symptoms of which will vary to a certain extent according to the nature of the ostitis, as will be readily understood from what has been previously stated regarding the different varieties of inflammation of bone. Sooner or later the soft parts contiguous to the bone participate in the inflammation; and if the affected part be situated near the surface, a swelling is in some little time observable. This swelling is firmly adherent to the bone, and the skin over it becomes red, tense, and painful. It ultimately becomes soft, indicating the presence of suppuration; and if opened, or allowed to proceed without interference, the matter which escapes from it is thin and offensive, and rarely presents the characters of well-formed pus. After the discharge of the contents of the abscess, either spontaneously or on opening it, the cavity does not heal; but continues to discharge matter which tarnishes a silver probe, is thin, ichorish, and offensive, and has that peculiar fœtor by which, without any other symptom, it is possible to determine with considerable certainty that it proceeds from a part connected with a diseased bone. The fœtid matter is loaded with a considerable quantity of phosphate of lime. The aperture of the abscess contracts and takes the form technically called fistula, and throws out from its edges granulations, which are spongy, painful, and very apt to bleed on being touched with the probe. The granulations project beyond the margin of the aperture, and the surrounding integument exhibits a livid hue. If a probe be introduced into the aperture, the bone is found to be rough and denuded, its surface irregular, and the osseous texture so much softened that, with the slightest pressure, the probe will sink into it to a considerable distance. The impression communicated to the surgeon on making an examination with the probe, is not precisely the same in every instance of caries, the condition of the bones being different, as was before mentioned, in different forms of the disease. In caries of deep-seated bones, as, for example, in scrofulous caries of the vertebræ, the accompanying collection of matter exhibits the characters of a chronic, instead of those of an acute abscess. I have often been struck, in cases of scrofulous caries of the vertebræ and of other bones, with the fact that, in many instances, patients would scarcely admit that they had experienced any pain in any stage of the disease. The constitutional symptoms vary, in the first instance, according to the nature of the inflammation producing the caries, and the state of the patient's system at the time. In scrofulous caries the patient exhibits the strumous habit, and in general symptoms of scrofulous cachexy soon become very apparent. During the suppurative stage of caries, and more especially in cases where the caries communicates with an articulation, irritative fever comes on, but soon gives place to hectic fever, by which in unfavourable cases, such as when the caries is in inaccessible situations, the disease proves fatal. In some instances the only constitutional symptoms observable are those of hectic fever.

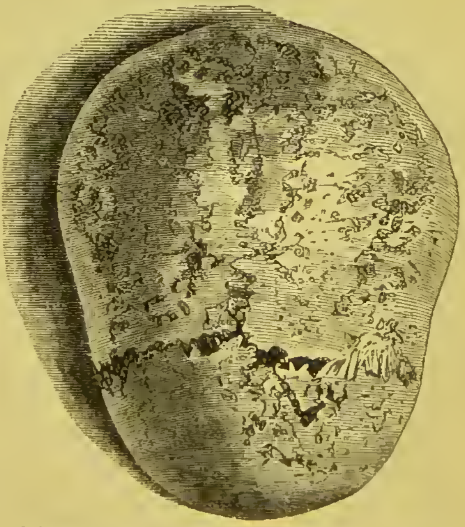
State of the parts.—The bone does not in every instance of caries present the same appearance. If the varieties in the state of the bone be made the basis of arrangement, it may be said that caries may exist in one or other of the three following forms :—

1st. That in which there is a regular and distinct excavation of a portion of bone. The extent of the disease, however, is by no means indicated by the extent of the excavation.

2nd. That in which the outer encasement or lamella of bone gives way, and the cancellated structure becomes carious without any distinct excavation. In this form the destruction by ulceration is very superficial, being confined to the outer encasement, but the alteration by interstitial absorption in the cancellated structure is very extensive.

3rd. That in which the bone has the appearance of having been perforated in innumerable places, termed the worm-eaten caries. This condition, no doubt the result of enlarged Haversian canals, is occasionally met with in the external surface of a long bone affected with the first form of caries, the perforations being found in the outer encasement in the neighbourhood of the excavation ; but the best examples of worm-eaten caries I have seen, have been in the cranium. In one admirable preparation of this form in my possession, the whole of the upper part of the cranium is occupied with innumerable perforations, and in another, the bones are in some parts bored in hundreds of places, and in others, affected with necrosis. In the first-mentioned specimen the bones have in every respect, with the exception of the perforations, a healthy appearance, no traces whatever being observable of any other disease, or of any deviation from the natural and sound condition of the osseous structure. In some other

Fig. 132.



Worm-eaten caries of the cranium. From a preparation in my collection.

specimens of this form of caries, I have been struck with the absence of any apparent traces of change of structure in the osseous substance, a circumstance in which this form seems occasionally to differ from the other two varieties. In the second specimen mentioned above, the subject was a girl twelve years of age, and the disease was occasioned by a blow.

In the first form of caries there may be said to be three different states. First, a part of the bone, where the excavation exists, is removed by ulceration. Second, the part which forms the surface of the carious portion is affected to a considerable depth by interstitial absorption, in consequence of which its lamellæ are so thin, and its circulation so feeble, that a healthy action rarely takes place. Its circulation is sufficiently weakened to create a great obstacle to the formation of healthy granulations, and yet not so as generally to deprive the part of all vitality and produce necrosis. It is in the presence of this interstitial absorption, that caries differs from simple ulceration. Third, beyond the interstitially absorbed part, the bone is often rendered preternaturally dense by the secretion of new osseous matter into its cancellated structure; and its external surface is, from the same action, covered over with nodules or spicula of new bone at the parts where there is a sound and firm bone underneath. In the second form the ulceration is very superficial, but the interstitial absorption very deep and extensive, and sometimes, as some specimens of it in the tarsal bones in my own collection demonstrate, it extends almost through the whole of the bone. When it is very extensive, the attempts at the formation of new bone in the neighbourhood of the interstitially absorbed part are very feeble, and in many instances no traces whatever of such an action can be discovered. Although the interstitial absorption frequently extends to a great depth, it is also certain, on the other hand, that occasionally it is very superficial, and the very limited extent of change of structure is sometimes remarkably disproportioned to the severity and obstinacy of the symptoms. Caries is in every instance a consequence of inflammation, and it may or may not be accompanied by the deposition of tubercular matter in the cancellated structure. When there is a deposit, it may present any of the varieties of appearance mentioned in the section on suppuration of bone, and, as is there stated, it may not be a product of inflammation, but a consequence of previous perversion of nutrition in a person of a scrofulous constitution. In some instances this deposit is limited to a small part, in others it is very diffused; in some it is contained in cells of the cancellated structure, and in others, as many of my own preparations evidence, it seems to occupy the whole space included within the shell of the bone, and scarcely any traces of the cancellated structure remain. When the deposit is present, the attempts to secrete new bone in the neighbourhood of the part involved in the caries seem to be in general extremely feeble, and such cases are in consequence exceedingly unpromising. Syme remarks, that after maceration a carious bone looks as if it had been burned, being harder, whiter, and more brittle than natural. I have sometimes been struck with this brittleness and hardness after long maceration and drying, in instances where, while the bone remained in the body, it felt so extremely soft, that a probe could with the slightest pressure, and almost without experiencing any resistance, be made to sink through it in any direction.

Rokitansky remarks, "It is thought by Delpech and Berard, Pouget and Sanson, and by Mouret, that a peculiar fatty matter is generated in carious bones ; Mouret differs from the others, however, in believing that the organic principle—the gelatinous portion—does not disappear from the bone." Rokitansky says, the sanies produced by the bone is an acrid fatty fluid, and almost always contains small particles of bone, discoloured and brittle, which look as if they had been calcined, and are, in fact, loosened remains of the bony tissue, which is being destroyed. They are, without doubt, minute particles of necrosed bone; for in every form of caries, small imperceptible particles of bone die, and are cast off. More rarely it happens, that necrosis of a larger piece of the ulcerating bone takes place (*caries necrotica*). In that case the portions of bone die, sometimes without partaking at all in the inflammatory process, and simply from the access of their fluids being cut off by the carious destruction which is going on around them; and sometimes from inflammation and disorganization.

DIFFERENT MODES OF SPONTANEOUS CURE.

Nature sometimes accomplishes a cure of caries in one or other of the three following ways:—

1st. By a complete change in the action of the diseased part, in consequence of which granulations form, which are converted into bone ; and a deposit of osseous matter thus taking place, the cavity is filled up in the same manner as a simple ulcer of bone.

2nd. By a process of exfoliation, by which the whole of the ulcerated portion of bone is thrown off, together with the parts rendered weak by interstitial absorption.

3rd. By anchylosis, or that process in which sufficient new callus or bone is thrown out to ossify the articulation.

Treatment.—In all inflammations of bone, such treatment should be adopted, as will be most likely to prevent them from terminating in caries. With this view local and general depletion, though necessary, must not be carried too far, as the consequent debility predisposes to caries; and as the danger of its occurrence is likewise increased by the interstitial absorption arising from the free use of mercury, this medicine, if ventured upon at all, must be exhibited with great caution. Simple ulceration of the bone should be healed as speedily as possible; unnecessary irritants should never be employed; abscesses must be opened, and "effused pus ought never to be allowed to remain on the surface of the bone, but must be early evacuated." If caries be the consequence of scrofula or syphilis, it is not so much under the influence of local treatment as of the proper constitutional treatment for those diseases.

When caries is fairly established, the treatment varies according to the situation of the disease. On this account, the situations of caries are divided into those accessible, and those inaccessible, to the surgeon. To the latter class belong caries of the vertebræ, and of the hip joint.

In accessible caries, unless there be great reason to hope for a spontaneous cure by one or other of the three processes already described, the best treatment is the complete removal or excision of the diseased portion of bone. On no account, however, should any attempt at removal be made, while acute inflammation exists in the bone or the neighbouring tissues. Although the carious part could be excised under such circumstances the operation, instead of being succeeded by a healing process, would, by increasing the inflammation, cause extension of the disease. With regard to the extent of removal, suffice it to say, that a firm, sound base should be left; the whole of the ulcerated and interstitially absorbed portion of bone should be removed. The instruments most serviceable for the excision or removal of the diseased part vary according to the situation. In some instances a scoop may be sufficient; in others, trephines, saws, knives, or the cutting forceps are required. After removal has been effected, the wound should be treated in the manner proper for a simple ulcer of bone. If the caries has been in parts which form an articulation, the bones must, after the operation, be kept in apposition, and at perfect rest. It sometimes happens that a patient cannot be persuaded to submit to the operation of excision. Under such circumstances, the most advisable procedure is to destroy the diseased part by means of the chloride of zinc, or the red oxide of mercury. For my own part, I prefer the former escharotic, but they both answer very well, and are not, like acids or liquid escharotics, liable to the objection of sinking deep into the substance of the bone, and thereby causing extensive and unnecessary destruction, or of increasing the disease. The escharotic must be employed so as to ensure the object of its application, namely, the complete destruction of the diseased part; and after it is taken off, some lint should be introduced into the wound, and poultices employed for alleviating the pain, and promoting the separation of the destroyed parts. When removal has taken place, the treatment proper for a simple ulcer of bone should be adopted. It sometimes happens, that after the surgeon has removed, by instruments, as much of the bone as seems advisable, a part still remains of a suspicious appearance, yet not so circumstanced that it would be judicious to remove it by excision. Some surgeons recommend that, in such circumstances, the suspected parts should be destroyed by one of the escharotics above mentioned; and the practice is often followed by the most satisfactory results. At one time the actual cautery was much employed for the destruction of carious parts. In regard to this practice, I cannot do better than quote the language of Mr. Liston :—"The application of the actual cautery may be by some considered necessary; at one time I employed this remedy very extensively in caries, and occasionally with very good success. I have since, however, been led to change my opinion, and am now inclined to prefer the potential cautery. By the application of the red-hot iron, the diseased portion is destroyed effectually, but, at the same time, the vitality of the surrounding parts is often very much weakened, and their power of reparation is diminished, so that they are incapable of assuming a sufficient degree of action for throwing off the dead part; their action being increased, while their power is diminished, they may become affected with caries, and thus, instead of being arrested, the original disease will either be increased, or extensive necrosis may take place."

When the caries is in situations inaccessible to the surgeon, that is to say, where it does not admit of excision, as in the hip-joint and the vertebræ, the surgeon should endeavour to obtain anchylosis. The most important means for this end are—every measure, which, in the condition of the patient, it may be judicious to adopt, for maintaining the general health and strength, perfect rest of the affected parts, and the employment of counter-irritation. If the vertebræ be the subject of the disease, the spine must be kept at rest, and in a reclining position, so as to remove from it the superincumbent weight. The treatment, however of caries in that situation will be particularly described in the section on diseases of the spine. If the knee-joint be the part affected, the limb ought to be extended, and kept in that attitude by means of a flat concave splint, applied behind the joint; if the disease be in the hip-joint, the trunk, thigh, and leg ought to be kept in a straight line with each other. Counter-irritants are also used with advantage. Those which are most generally preferred, and which are found to prove most beneficial are, blisters, small issues kept open by the occasional application of potassa fusa, and setons. Experience seems to show that, in some situations, some of the means for producing counter-irritation are employed with more advantage than others; but this will be more fully explained in the description of the diseases of the joints and of the spine. One important point, however, should always be kept in view, whatever be the application employed; and that is, not to produce such a discharge as would affect the general strength; for the maintenance of the patient's general health is fully as important as keeping up counter-irritation. When a collection of pus is perceptible, it must be opened by a small orifice in the most dependent part, and gentle pressure employed to keep the sides of the abscess in apposition.

NECROSIS.

This term, derived from νεκρόω, to put to death, is now, by the consent of surgeons, employed to denote the dead condition of bone. In the soft tissues, the state corresponding to necrosis is called mortification. Louis, who was the first to restrict the application of the term necrosis to death of bone, applied it only to death of the entire thickness of the bone, and not of the external or internal part, of which, however, there is frequently complete death, followed by removal. The bones most liable to necrosis, are, the tibia, the femur, the lower jaw, the clavicle, the fibula, the humerus, the radius, and the ulna; occasionally, also, the bones of the cranium are subject to it. While caries, as has been already noticed, is found principally to affect the spongy portions of bone, necrosis, for the most part, attacks those bones which are of a firm, compact texture. It may occur at any period of life, and in both sexes, yet we more commonly meet with it in young persons from twelve to eighteen years of age; but when it affects the lower jaw, it is seldom before the thirtieth year.

The *causes* of necrosis may be divided into external and internal. Of the former are severe contusions of bone; bad compound fractures; the pressure and irritation of tumours, of abscesses, or of a musket ball; acute ostitis; or the application of strong concentrated acids. It frequently results also from severe cold, and occasionally from burns. Destruction of the medullary membrane is found, by experiment on the lower animals, to produce necrosis. Another cause of necrosis lately met with is the inhaling of phosphorus, and this has been found chiefly in persons engaged in lucifer-match manufactories. The phosphorus being inhaled causes periostitis of a very severe character; and necrosis of the whole of the lower jaw has of late been repeatedly noticed as a result. Some interesting cases are now recorded in which Carnochan and Wood have successfully removed the whole of the jaw on account of this disease. The internal causes are such as affect the bone through the medium of the constitution. Scrofula, syphilis, and the baneful influence of mercury on the constitution, seem to produce a considerable tendency to necrosis.

If necrosis take place without any known exciting cause, it is said to be idiopathic; if it be the consequence of a compound fracture, it is called compound; if it be caused by violence, as by a blow, it is denominated traumatic.

Varieties of Necrosis.—The different forms or varieties of necrosis are by some arranged into two, by others into three, separate and distinct species. We shall, however, consider four varieties.

1. That form which generally occurs in a person of a scrofulous habit of body, and in which the short bones are affected, as those of the tarsus, metatarsus, carpus, or metacarpus.

2. That form in which there is death only of the outer lamella, that is, in which the disease is superficial, and does not extend through the whole thickness of the shell of the bone. This form presents itself in the flat bones, as the scapula, and the bones of the cranium, as well as in the long bones.

3. That form which destroys the internal part of a bone, and in which the cortex or outer shell is not affected. This is by some writers called internal necrosis.

4. That form, in which the whole thickness of a bone perishes. The three last-mentioned forms may be distinguished from each other by the names of external or periperal, internal or central, and general necrosis, named by some necrosis totalis, to distinguish it from the external and internal, which they comprehend under the head of necrosis partialis.

Symptoms of the First Form.—An indolent swelling first presents itself, unattended with much pain or constitutional disturbance. The swelling is at first hard, after some time œdematous, and at length attended with fluctuation in consequence of a thin ichorish fluid collected in the part. If a probe be introduced, the bone will be felt to be rough, and divested of its periosteum. The aperture has little tendency to heal. In consequence of the continued irritation, hectic fever is produced. As in this form nature makes no attempt at reproduction, removal of the limb is absolutely necessary.

Symptoms of the Second Form.—These, in the first instance, depend upon the cause of the disease, which is often an acute abscess, or acute periostitis, or acute ostitis. A small abscess occurs in the soft parts, which, if left to nature, discharges itself. If a probe be introduced, the bone is found to be bare, and a part perhaps loose. The aperture does not heal until the sequestrum or dead portion of the bone is removed, but becomes what is technically called a fistula. The separation of the sequestrum is effected by the absorbents taking up the next layer of bone, and bears an analogy to that process by which sloughs of the soft parts are detached. The aperture now heals by granulation in the same manner as in simple ulcer of bone. This form of necrosis has by some writers been called exfoliation.

Symptoms of the Third Form.—There is most excruciating pain, supposed to arise from the resistance offered by the cortex or outer lamella to the swelling of the inflamed part. The inflammatory fever is often so high as to prevent the patient from obtaining repose. The swelling is exceedingly hard and diffused, depending on the swollen condition of the bone. It also continues for a very long time, before anything unnatural is observed in the soft parts; but in them an abscess gradually forms. The pain is not aggravated, as in other forms of this disease, by pressure or handling of the limb. The other symptoms nearly correspond with those of general necrosis.

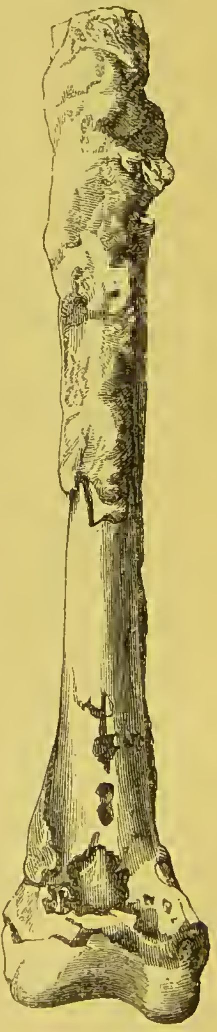
Symptoms of the Fourth Form.—In this form of the disease the articulatory extremities are not generally involved. Pain of a most excruciating, girding, bursting character is one of the earliest symptoms. The pain is constant, and is followed by a swelling, which is diffused, presenting no distinct bounds, but generally greater about the middle of the limb than elsewhere. The character of the swelling at first is doughy and elastic, by reason of the effusion between the periosteum and the bone, and the thickening of the periosteum itself. This is followed by a soft swelling, which is less effused, and ultimately attended with fluctuation, and presents the ordinary local symptoms of an acute abscess, which, if permitted, finds an outlet for itself. If a probe be introduced after the contents of the abscess are discharged, the bone will be found to be bare, and ultimately becomes loose. The pus itself is thick, yellow, and of a healthy, purulent character. After the evacuation of the abscess, there is some diminution of the pain; but the opening has no disposition to heal, and presents the appearance which is technically called fistula. After the matter is discharged, there is but little subsidence of the swelling, which is general, presenting no distinct boundary, and of a firm, unyielding kind, depending at this advanced stage on the deposition of new bone, and certain conditions connected with that process.

Constitutional Symptoms.—Violent inflammatory irritative fever attends the first stages of necrosis. If the constitution be good, and not reduced by long-continued and extensive suppuration, hectic fever may not come on; but there is much reason to apprehend it, if the constitution be feeble, or the disease very extensive, or the articulations affected.

Sequestrum.—The sequestrum, or dead portion of bone, is always of an ivory white appearance, except when it is exposed to the atmosphere through the soft parts, or is situated at the bottom of a large ulcer; it is then of a dark brown, or even black colour, in consequence of the action of the air. When the sequestrum is struck with a probe or piece of metal, it emits a peculiar hollow sound, and is thus readily distinguished from sound bone. In general necrosis, that is, when the whole thickness of the shaft perishes, the sequestrum is situated within the newly deposited bone; in other words, the new bone surrounds or embraces the sequestrum, which is observed to be somewhat reduced in size, in comparison with the original bone. Some authorities suppose, that the absorbents have the power of removing a portion of the sequestrum into the system. Hunter, Blizzard, and Russell held this opinion; as do also Lawrence, Velpeau, and others.

Gulliver, Stanley, Liston, and many others, maintain, that the sequestrum cannot be acted on by the absorbents. Mr. Liston observes :—"But a dead portion of bone detached from the surrounding parts is in every respect an extraneous body, and is not, and cannot be acted on by the absorbents any more than a piece of metal, wood, or stone. Some have gone so far as to affirm that portions of foreign bodies, ligatures, &c., are absorbed, but this opinion is altogether too absurd to require any contradiction ; the knots of ligatures, like portions of glass or other foreign substance, become surrounded with a dense cyst, and often remain in the body for a long time ; so do portions of dead bone, separated by the process here described. A series of experiments were made by Gulliver, in order to put this question at rest, many of which I witnessed and assisted at, and several also I repeated. Setons of bone were inserted, and worn for a long time ; thin plates of bone were confined on suppurating surfaces, pieces of bone were inserted in the medullary canal of various animals, and kept there for months, and in one instance for more than a year. These foreign bodies were weighed with the greatest care and accuracy before and after they were so exposed, and were found unaltered in any respect." That the sequestrum is often much less than the original bone is a fact which is beyond all doubt ; but absorption does not, and cannot take place, except through the medium of the vessels of the sequestrum, before it has lost its vitality.

Fig. 133.

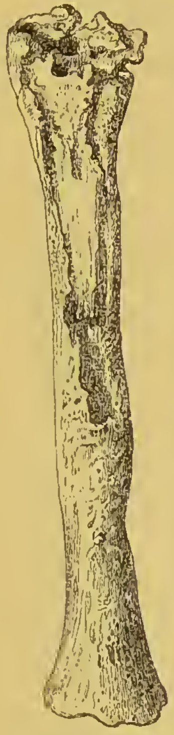


Drawing of a preparation in my own collection.

Separation.—Respecting the process by which the dead portion of bone is separated from the living, the older writers had very vague ideas, but the investigations of Wiedmann have set this question at rest. "The parts surrounding the dead portion directly become preternaturally vascular. A groove is next formed all round the sequestrum, which is generally believed to be produced by the action of the absorbents of the adjoining living bone, or, as Hunter first demonstrated, the groove is formed by the absorption and disintegration of that part of the living bone which is contiguous to the dead ; its earthy matter being first taken away, and then its animal part, the groove begins on the surface, and extends gradually more and more deeply, until the dead portion is completely undermined and detached." Separation having been effected, the expulsion or elimination of the loosened sequestrum is promoted by the growth of granulations below it, and in some situations the mere growth of these granulations pushes it from the part on which it is placed.

Reproduction.—The power of reproduction varies much in the different bones of the body, being great in some, and less in others, while there are those in which it is not at all manifested. It is, of course, much greater in young healthy subjects, than in old debilitated persons. Though the long bones, the lower jaw, the clavicle, and the scapula possess the power of reproduction to a very considerable extent, the short cuboid bones cannot be reproduced. A case is related by Wiedmann, in which nature effected reproduction of nearly the whole of the lower jaw; and one by Chopart, in which the clavicle was reproduced. An instance is also on record, of the reproduction of nearly the whole of the scapula. Portions of the cranium under particular circumstances may, to a certain extent, be reproduced; but if both the tables of the cranium be destroyed, together with the pericranium, there will be very slight reproduction; for the dura mater has very little tendency to form new bone. This is the reason why, after the operation of trephining, the pericranium and both tables of the skull being removed, reproduction does not take place to any great extent.

Fig. 134.



Entire regeneration of Tibia. Drawn from a preparation in my own collection.

From what source is the New Bone derived?—This is indeed a "quæstio vexata." Different pathologists give different answers to the following questions, Whether nature, for the accomplishment of her purpose, employs the vessels of the periosteum—or those of the medullary membrane—or those of the old bone itself? It seems clear that in external necrosis, new granulations spring up from the living bone, and reproduction is effected in the same manner as in simple ulcer of bone. In internal necrosis, it is supposed that the living cortex or outer lamella of the bone, which becomes preternaturally vascular, swollen, and softened, is the source of the new bone. That it cannot be by the vessels of the medullary membrane, is manifest from observation; for in this form of necrosis the medullary membrane is completely destroyed. In general necrosis, or those cases in which the entire thickness of a bone, and the medullary membrane perish, it is believed that the new bone is derived from the periosteum of the old bone. Duhamel first mooted this opinion, which Troja afterwards supported. Troja produced necrosis by passing a red-hot iron into the medullary canal of various animals, and he ascertained that, when a portion of bone is about to perish, the periosteum becomes detached and raised up from the bone, and the space is occupied by purulent matter. Macartney had an opportunity of witnessing this separation of the periosteum from the bone in the human body, in consequence of destruction of a small portion of the medullary membrane by disease. The periosteum becomes very vascular, and thereby is rendered soft, pulpy, villous, and perfectly red on the surface in contact with the bone, the cellular tissue external to it also becoming swollen. The central part of the periosteum is next converted into cartilage, and afterwards into bone, so that the new bone is formed in the centre of the periosteum. "Some pathologists deny the ossific power of the periosteum, and claim the whole production of new osseous substance for the bone itself. That the process of reproduction may be accomplished in this way, I am not prepared to deny, but that it is not necessarily or always so performed, will, I think, appear from the following case and experiments by Syme :—" A girl, twelve years of age, strained her ankle, in the month of March, 1835. Inflammation followed, extending up to the knee, and attended with violent fever. She was brought to the hospital, and placed under my care. Incisions were soon afterwards made to evacuate a large collection of matter, which had formed in the leg ; and the bone being found dead, while the patient's strength was rapidly going away, I amputated the limb above the knee, five weeks after the injury had been received. The girl recovered, and is now well. In examining the limb, to ascertain the extent to which the bone had died, I found that it was partially surrounded by the commencement of a new one. The shell had already acquired considerable firmness at some parts, but was not equally thick throughout, and did not seem fixed to the ends of the old shaft. This observation led to a very careful dissection of the parts concerned ; and they are now before the Society. It will be seen that the tibia had died very nearly from end to end, and that the new shell enclosing it has been formed in the periosteum. The new osseous substance may be observed at some parts, in the form of distinct scales. At other parts, it looked as if it had originally consisted of separate portions, and been formed by their union. The periosteum connecting these portions to each other, and to the extremities of the bone, was not thickened beyond its natural condition, and where it covered the posterior surface of the tibia, though quite detached from the old bone, had not suffered any further change. There is here, then, an instance of a bone dying suddenly in consequence of acute inflammation, without any thickening being previously found in its neighbourhood, and nevertheless succeeded by the production of a new osseous shell, which evidently could not proceed from the old bone, and no less evidently depended on an ossific process resident in the periosteum. As nature is not capricious or variable in her proceedings, I regard this case as sufficient of itself, without any further evidence, to establish the ossific power of the periosteum. But with the view of making the matter still more clear, I performed the following experiments :—I exposed the radius of a dog, and removed an inch and three-quarters of it, together with the periosteum. At the same time I exposed the radius of the other leg, and removed a corresponding portion *without* the periosteum, which was carefully detached from it, and left quite entire, except where slit open in front. Six weeks afterwards the dog was killed, and the bones examined. In the one from which a portion had been taken, together with the periosteum, the extremities were found extended towards each other in a conical form, with a great deficiency of bone between them, and in its place merely a small band of tough ligamentous texture. In the other, where the periosteum had been allowed to remain, there was a compact mass of bone, not only occupying the space left by the portion removed, but rather exceeding it in thickness. This experiment, when repeated, afforded the same results.

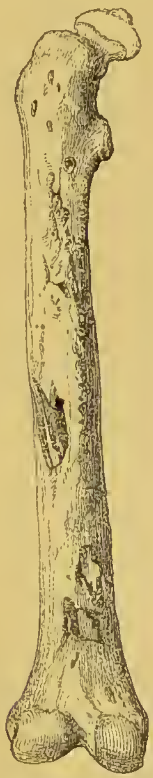
"I next exposed the radius of another dog, and separated the periosteum from the bone, as in the former experiment; but then, instead of cutting out the denuded bone, inserted a thin plate of metal between it and the periosteum. The edges of the membrane, and then those of the skin, were sewed together, and the wound healed kindly. At the end of six weeks I dissected the limb, and found a deposition of osseous substance in the periosteum, forming a bony plate exterior to the metal, and not connected to the old bone, except by the membrane. I lastly exposed the radius of a dog, and cut away the periosteum to the same extent that it had been detached in the experiment just mentioned, and surrounded the denuded bone with a piece of metal. At the end of six weeks I found a thick tough capsule formed, enclosing the metallic plate, but having no osseous substance in it. The evidence which has now been adduced seems to me sufficient for putting beyond all question the power of the periosteum to form new bone, independently of any assistance from the old one."

From the case and experiments published by Syme, it seems warrantable to conclude, that the new bone is formed within the centre of the old periosteum, which first undergoes the various preparatory changes already described. The observations of many other authorities have led them to the same conclusion; and I have for years exhibited to the Class of Surgery in Marischal College, a beautiful preparation, still in my possession, which most clearly demonstrates the vascularity of the inner surface of the periosteum, the deposition of ossific matter within its centre, and the perfect continuity of the altered portion, in which is contained the new bone, with the periosteum of the neighbouring portions of bone which are not involved in the disease.

Such seems to be the correct doctrine regarding the source of new bone in general necrosis; but there are some who embrace this opinion only in part. They agree that the new bone is derived from the periosteum as its source, but consider that it is not developed in the centre, but formed on its inner surface; and affirm that a secretion of lymph takes place between the inner surface of the periosteum and the bone, "which undergoes the preparatory change into cartilaginous tissue previous to its ossification." If this opinion be correct, it is difficult to explain the vascularity of the interior of the new bone.

Macartney believes that the new bone is formed from the periosteum, but seems to think that it is not developed in its centre, as the experiments and case of Syme, and the preparation in my own museum, tend to prove, but formed on its inner surface; and he describes the original periosteum as disappearing, not as becoming afterwards attached to the new bone. He remarks that "the first and most important circumstance is the change which takes place in the organization of the periosteum; this membrane acquires the highest degree of vascularity, becomes considerably thickened, soft, spongy, and loosely adherent to the bone. The cellular substance also, which is immediately connected with the periosteum, suffers a similar alteration; it puts on the appearance of being inflamed, its vessels enlarge, lymph is shed into its interstices, and it becomes consolidated with the periosteum. These changes are preparatory to the absorption of the old bone, and the secretion of the new osseous matter, and even previous to the death of the bone which is to be removed. In one instance I found the periosteum vascular and pulpy, when the only affection was a small abscess of the medulla, the bone still evidently retaining its connexion with the neighbouring parts, as it readily received injection. The newly organized periosteum, &c., separates entirely from the bone, after which it begins to remove the latter by absorption; and while this is going on, its inner surface becomes covered with little eminences resembling granulations. In proportion as the old bone is removed, new osseous matter is dispersed in the substance of the granulations, while they continue to grow on the old bone, until the whole or a part of it is completely absorbed, according to the circumstances of the case. What remains of the investment after the absorption of the old bone and the formation of the osseous tube which is to replace it, degenerates, loses its vascularity, and appears like a lacerated membrane. I have never had an opportunity of examining a limb, a sufficient time after the termination of the disease, to ascertain whether the investment be at last totally absorbed; but in some instances I have seen very little remaining. During the progress of the disease the thickened cellular substance which surrounded the original periosteum, becomes gradually thinner, its vessels diminish, and it adheres strictly to the new formed bone, to which it ultimately serves as a periosteum." I have introduced the above extract because it well describes some points, and gives a distinct account of the writer's views; but from what has been previously stated, it will be seen that I follow the authorities whose views do not altogether coincide with these. Stanley is of opinion that when necrosis is attended with destruction of the bone and of the medullary membrane, the bone may be regenerated from three sources, namely, from the periosteum which invested the old bone, or from the articular ends of the old bone; or, if the periosteum be destroyed, from the soft parts which surrounded it. He states that he destroyed the medullary membrane in a dog's tibia, and removed the periosteum, and yet reproduction ensued from the vessels of the surrounding cellular tissue, which became exceedingly condensed, so as to form a periosteum. The results of some of the experiments of Dupuytren, Breschet, and Villermé, on the formation of callus, in some respects agree with the evidence furnished by the experiment of Stanley.

Fig. 135.



Drawn from a preparation in my own collection.

In internal necrosis the separation of dead bone from living proceeds in the manner already described, and the sequestrum is contained within the sequestral capsule, formed partly by the old bone, the outer layer of which expands and grows during the continuance of the suppuration by the dilatation of its Haversian canals, and the formation of new bone in their interstices. Around the shell of expanded old bone there is formed also a portion of new bone by the periosteum, and they together compose the sequestral capsule in internal necrosis. As soon as the sequestrum is removed from its shell, the mass of granulations on the inner surface of the old bone ossifies, and instead of a medullary tube, there is formed a solid cylinder of bone. But it has been stated by a great authority on this subject, "at a later period, a gradual enlargement which takes place in the Haversian canals of the new bone, changes its structure into cellular, and incompletely supplies the place of a medullary tube." When the process of regeneration is completed, the bone consists, from without inwards, of the bone formed by periosteum, the outer layer of old bone which did not become necrosed, and of the central portion of new bone formed by the granulations within, and which come for so long to occupy the place of a medullary canal. The interior, at first solid, becomes opened up at last in a manner already mentioned, and the boundary between the new and old portions of the sequestral capsule ceases to be distinguishable, and the misshapen, expanded mass eventually takes on the natural form, and appears like one homogeneous formation.

Cloacæ.—In the sides of the newly formed bone are observed a number of foramina, called by Wiedmann, *cloacæ*, and by Troja, *foramina grandia*, which serve as an outlet for the extraction of the sequestrum, provided it be not too large, and for the escape of the purulent matter confined within the cavity of the bone. The cloacæ generally present themselves in the middle or under-third of the bone, and are usually of an oval shape, and oblique in their direction. Davies and some others suppose that the cloacæ are formed by the matter secreted in the interior of the new bone, which, from its great quantity, distends, and ultimately bursts the periosteum, thereby giving rise to these apertures. According to Wiedmann, this doctrine is incorrect, for cloacæ are observed in situations where matter does not exist. Others attribute their formation to the corrosive qualities of the pus; but it seems more probable that they are occasioned by the non-deposition of osseous matter, at certain parts in the centre of the periosteum. In some preparations, the parts where bone has not been deposited, are filled up by periosteum. In a preparation in my collection, there are several cloacæ filled up by periosteum, which is evidently continuous with that which covers in, and that which lines the outer and inner surfaces of the neighbouring portions of new bone, these portions being clearly deposited in the centre of the periosteum.

After the entire removal of the sequestrum, "the new bone gradually becomes consolidated and smooth on the surface, by the action of the absorbents, and is lined by a medullary membrane."

Treatment.—Preventive treatment should be first employed with an activity commensurate with the severity of the symptoms, and the strength of the patient. If the ostitis proceed from syphilis or scrofula, in addition to other remedies, the preparations of iodine, especially the iodide of potassium, with sarsaparilla, will be found valuable. As soon as the existence of purulent matter is detected, free direct incision should be made: which will save much time, alleviate suffering, spare the strength of the patient, and circumscribe the extent of the disease. If hectic fever supervene, the strength of the patient must be supported by means of tonics, pure air, and suitable diet and regimen, until the process of separation be completed. In fact, the duty of the surgeon during the process of separation, which is a work of nature, is to keep the limb in a quiescent state, and to combat all untoward symptoms as they may arise.

The Process of Extrusion.—The efforts of nature in this process being feeble, the surgeon ought to interfere, and afford the necessary assistance for the removal of the necrosed part. The proper period for this interference is, when the sequestrum has been separated from the living portion; but first, the surgeon should consider the course of the cloacæ, and endeavour to form some opinion of the size of the sequestrum; then he should make a free direct incision, generally longitudinal in its direction, not too long, as there is danger of hemorrhage, nor too short, as the difficulty of extraction would be thereby increased, and the operation rendered unnecessarily tedious. When the sequestrum is loose, it may easily be removed by means of a pair of forceps, if the cloacæ be sufficiently large. Sometimes it is necessary to cut a portion of the new bone which confines the sequestrum, or to divide the sequestrum itself by Liston's forceps, or Hey's saw, or some other convenient instrument. "The instruments," Liston observes, "and especially those for extraction, ought to be very powerful and suited to the purpose; for in the employment of inefficient means there is much folly and cruelty." After the operation, which is generally attended with a profuse hemorrhage, the wound should be filled with lint, and the limb placed in an elevated position. Antiphlogistic means may be necessary to prevent ostitis.

There are certain unfavourable cases of necrosis in which amputation is not only warrantable, but indispensable. If the hectic fever, caused by the long-continued suppuration, threaten to prove fatal; or if the neighbouring articulations become involved in the disease, amputation is the only possible means of saving the patient's life. The bones of the tarsus and carpus, as was previously stated, are never reproduced; and sometimes, in very weak debilitated persons, there is no reproduction in the long cylindrical bones. In these cases also amputation is admissible. "The treatment," Liston says, "may be summed up in a very few words. Prevent the necrosis if possible, open abscesses whenever they appear, encourage the patient to move the neighbouring joints, support the strength, remove sequestra when loose, but do not interfere until they are ascertained to be so, give the limb proper support and rest when a large sequestrum is formed. When fracture has taken place, when the health has been undermined, or when neighbouring joints have become diseased, amputate in order to save the life, if it be impossible to save the limb."

RICKETS.

The spine was by the Greeks called ῥαχις, from which is formed *rachitis*, strictly meaning, disease of the spine; and from rachitis is derived the English word *rickets*. The terms rachitis and rickets are not, however, used to denote a disease of the spine, but one in which there is a preternatural softness of the osseous system, affecting the spine in common with other parts; and these names were originally applied to the disease from an erroneous impression which at one time prevailed, that it originated in the vertebral column. It is a remarkable fact, that this disease appears to have almost escaped observation until the middle of the seventeenth century, there being no distinct account of it given by the ancients, nor by any author of the Middle Ages. It was first described by David Whisler, in 1645, but it was more fully described by Glisson, in 1671. The last-mentioned author states, that it first appeared in England in the middle of the seventeenth century, since which time it has been a well-known disease in these islands, and in many other parts of Europe. It can scarcely, however, be supposed, that the disease did not exist previously to the above period, but that it had escaped particular observation. Dr. Craigie remarks, "Deformed dwarfs have been known in all ages; the *gibbi*, the *vari*, and the *valgi* of the Romans must have been more or less rachitic in their infancy. From this cause the deformity of Thersites might have originated. It is also to be remarked, that Fabricius Heldanus delineates the serpentine lateral curvature of the spine in a girl of eight, whose bones were soft as wax, which could be produced by no other cause save rickety softness."

Symptoms.—This disease generally attacks children between six months and three years of age; but it is often known to occur at an earlier period, and a few instances are recorded of its taking place in the fœtus. Pinel describes the skeleton of a rickety fœtus. University College Museum contains a splendid specimen which I have examined; and Sœmmering, Bordenan, Loder, and others testify to the fact that the disease is sometimes met with in the bones of the fœtus. From a state of apparent vigour the child begins gradually to decline in health, and to lose his liveliness; the muscles diminish in size and become loose and flabby, causing that diminished appearance of the extremities and neck, which contrasts strangely with enlargements perceptible in other parts of the body. In the progress of the disease there is much general weakness; the skin loses its elasticity and becomes pale, and, in aggravated cases, of a dusky appearance; the digestion is often impaired; the breath has a sour smell, and the abdomen becomes enlarged, and has to the touch a doughy feeling: this enlargement, for the most part, arises from distension of the intestines with gas. It has sometimes been believed to be produced by disease of the spleen, or of the liver, and more especially of the mesenteric glands. There can be no doubt that in patients affected with rickets, these organs are often found in a diseased state; nor is this at all surprising: but that such disease forms no essential part of the state of the body in rickets, is evident from the fact, that, in many instances, there is found no diseased condition of any internal parts except the bones. There is softness of the bones from the interruption of the ossific process; and becoming, in consequence of this softness, flexible and incapable of offering resistance, they yield to the superincumbent weight and to the action of the muscles; and hence result various unnatural conditions observable in the extremities, the spine, the chest, the pelvis, and the head.

The upper and lower extremities frequently exhibit a remarkable contrast of appearance; the former, from not having to support any weight, are in general proportionate and free from curvature, while the latter are bent so as to become much shorter than natural. The bones give way principally from the effect of the superincumbent weight, and partly also from the effect of the muscles. The form which they assume in the limbs is generally an exaggeration of the natural configuration; by which I mean, an unnatural degree of the curvature proper to the bones. The lower limbs exhibit great varieties of deformity; they are often bent laterally by the action of the muscles, and in such cases they are always bent to the side on which the muscles act most powerfully. The femur may be bent forwards, or laterally, or forwards and outwards; the tibia may exhibit a curvature forwards; or the knees may both fall inwards with the feet thrown outwards; or both the extremities may be together thrown to one side, forming a curvature of the whole length of the extremities, with the greatest convexity at the knees and directed to one side, and the concavity to the other. Although, as it has been already stated, the bones of the upper extremities are more rarely affected than those of the lower, yet they do sometimes suffer to a certain degree both as to length and size. The clavicle may be bent unnaturally forwards, partly by the weight of the shoulder, and partly by the action of muscles going from the front of the chest to the bones of the extremity; and the humerus, radius, and ulna may also become bent in directions determined by the actions of the muscles. The spine exhibits in a marked degree the effects of rickets, the weight of the head, and other superincumbent parts, bending it in various directions; and with distortion of the spine is usually associated deformity of the chest, which is sometimes flattened laterally by the ribs falling in on both sides, in which state the sternum is pushed forwards, and the front of the chest acquires somewhat of the form of that cavity in a bird, and hence the expres-

Fig. 136.

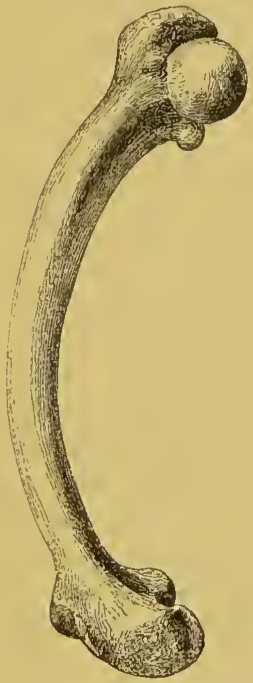


Fig. 137.

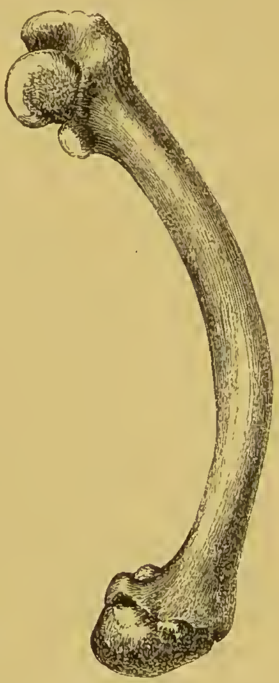
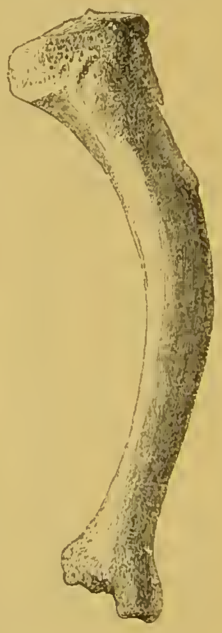


Fig. 138.



From preparations in my own museum.

sion "chicken-breasted" has been used to describe that peculiarity of form. The chest, in these cases, may be flattened on one side and rendered very convex on the other, as in lateral curvatures of the spine produced by other causes. The chest is shortened on the flattened side, and the intercostal spaces very much diminished from above downwards; whereas, on the convex side, the chest is lengthened and the intercostal spaces are larger than natural. This condition of the chest often occasions a compression of the thoracic viscera, and thus interferes with the easy performance of their functions; hence arise the difficult breathing and palpitations which are frequently observable in such cases. With respect to the pelvis it was the opinion of the late Mr. John Shaw, that it will be found distorted only in those cases where marks of rickets are found in other parts of the skeleton besides the spine and chest. He made an examination of an extensive series of skeletons in which there was curvature of the spine; and found that in some, the deformities were confined to the spine and chest, while in others, he observed marks of rickets in other bones also; but in no single instance of the former class did he find any distortion of the pelvis; and he therefore concluded that in cases of rickets, although the spine and ribs may be deformed, the pelvis will not be found distorted, unless the disease affect the skeleton generally. The distortions of the pelvis are various; the bones may be pressed to one side, or the inlet may be diminished from before backwards; or if the softening be very great, and the patient be able to walk, the ossa innominata may, to a certain extent, be approximated towards each other at certain parts by the pressure of the thigh-bones against the acetabula. The head is larger than natural, and has a singular appearance from its two grand divisions becoming disproportioned to each other, the facial portion retaining its natural size, while the cranial appears much enlarged. The enlargement of cranium is, however, more apparent than real. It appears larger than it really is, owing to want of development of the bones of the face. The usual appearances about the head are discoverable at an early period; indeed, according to Killian, they constitute the earliest symptoms of

Fig. 139.

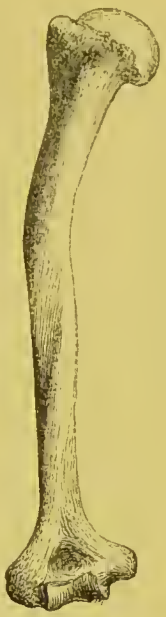
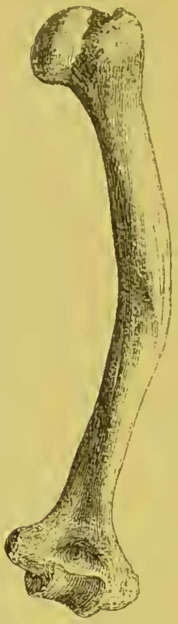


Fig. 140.



From preparations in my own collection.

rachitis. It is an observation made by some authorities, that in rickety patients there has been found a more early development than usual of the mental faculties.

State of the parts.—In rickets, the earthy matter is deficient, and the bone is light, spongy, and soft, of the consistence of cartilage, and is easily cut with the knife. The vessels of the bone appear numerous and large, and are loaded with dark-coloured blood. The bone is of a red colour varying in shade from pink to brown. The walls of the long bones become very thin, while the bones of the cranium are considerably increased in thickness, but are changed in structure so as to become reticulated and spongy. The interior of the long bones presents, as during fœtal life, a loose and reticulated arrangement, with somewhat of the appearance of a homogeneous substance instead of a distinct medullary cavity and cancellated structure; and instead of being filled with medullary or any oily secretion, as in the healthy state, it contains a reddish or brownish serum. The periosteum is said by Bichat to be generally thickened; other observers have also found it thickened and detached; but Stanley, who examined an extensive series of bones affected with rickets, did not find this thickened appearance. It has appeared to me more vascular than natural, somewhat tumid, and to adhere more firmly than usual to the bone. The condition of bone above described may be succeeded by one of growth and strength, in which the bones increase in density and size by a process resembling, with one exception, that by which the natural growth of the bones in a sound state is carried on. A medullary canal is formed; instead of the reddish serum, the natural oily secretion is deposited; and the distinction between cancellated structure and the compact shell becomes perceptible. The great peculiarity is, that the bones become thickest at the smaller curvatures, where the power of resistance is most required, and the deposition not only takes place on the outer surface, but in some specimens extends into the interior, so as to encroach on the medullary canal, which has been known in some instances to have been at certain parts even obliterated by it. In the adult the bones are often found to be stronger than in the natural state—their firmness has been compared to that of ivory, and the term eburnation has in consequence been given to this condition.

Gross, in his description of the morbid anatomy of rachitis, gives three stages:—In the first, the bones are saturated with a reddish, watery fluid, which at a more advanced period of this stage is replaced by a gelatinous substance particularly conspicuous between the medullary membrane and bone, and between the bone and periosteum, which he describes as thickened; in the second stage, a spongoid substance of considerable thickness is formed between the periosteum and bone—the bone is so soft as to be easily bent or cut, or even indented with the finger; and in the third, the recently formed structure becomes identified with the bone which regains its primitive solidity.

Rokitansky's description will be perused with interest: "The texture of the bones is affected in two ways, of which sometimes one predominates, sometimes the other. In the *first* case the bone is rarefied and increased in size—expanded, in fact. A pale yellowish-red jelly is effused into its enlarged canals and cells, into the medullary cavities, and even under the periosteum. The bone itself is abundantly supplied with vessels, and full of blood, and its colour is therefore darker than natural, and red. Occasionally this change reaches to such a degree, that the cells of the spongy bones, and those in the interior of the medullary tubes, become excessively distended, and, as their walls disappear, are merged into larger cavities; medullary cavities become single spacious chambers, and the bones uncommonly soft and fragile (Guérin's Consomption Rachitique). In the *second* case the bone is, in addition, deprived of more or less of its mineral constituents; and sometimes it is completely reduced to its cartilaginous element, and appears like a bone that has been steeped in acid. The bony corpuscles are empty, and their rays have disappeared, and when this is the case, the lamellar structure is here and there obliterated; at other parts the lamella appear, as it were, to have fallen asunder, and the corpuscles are seen quite distinctly interspersed between them. It is upon this condition that the flexibility of rickety bones depends. It is remarkable, that in cases of general rickets, the reduction of a bone to its cartilaginous element so preponderates in some bones, as to go on, even to completion, without any trace of rarefaction."

Treatment.—The proper treatment consists in the employment of all judicious and available means for removing weakness of constitution, and strengthening the general system. For that purpose the most appropriate remedies are, residence in a dry and pure air; sleeping in a large, airy apartment; free exposure to the light and to the sun's rays; nutritious diet, comprising the regular use of animal food, cream, and cod-liver oil, attention to clothing, and particularly in the cold season wearing enough to keep up free cutaneous circulation; cold or sea-bathing at the proper season, if the patient be strong enough to undergo the exertion, and if that should not be found advisable, bathing in tepid salt water, or sponging the body; and the regular employment of friction by means of the hair-glove or flesh-brush. Methodical friction is of great importance in this complaint. The state of the digestive system, and particularly the due regulation of the bowels, should be attended to; and, together with the above means, which are of the utmost importance for strengthening the general system, it is advisable to give some tonic medicine. Of the various remedies belonging to that class, the preparations of iron are employed with the greatest advantage. Exercise to an extent not inducing fatigue is beneficial; but after exercise, and occasionally at different other periods during the day, the patient should recline, to relieve the weak parts from the pressure of the superincumbent weight. The use of the phosphates at one time so much employed on account of the deficiency of earthy matter has been recently revived, but I cannot from personal experience bear testimony as to the result. Rokitansky has remarked that "rickets is associated with tubercle very rarely." Notwithstanding this fact, the treatment proper for the scrofulous diathesis is that which is found useful in rickets.

MOLLITIES OSSIUM.

The disease known by the names mollities ossium, osteomalacia, malakosteon, and osteo-sarcosis, is extremely rare, and appears to have been unknown to the ancients. The first distinct account of this malady was given by Gabriel in 1688. He met with an instance of it in a lady, whose bones were flexible, and converted into a reddish substance destitute of fibres. Cases were published in 1691 by Saviard, and in 1700 by Courtial and Lambert; in the "Memoirs of the Royal Academy of Sciences" for 1752, Morand detailed the remarkable case of Madame Supiot, and since that time many well-marked examples are recorded by different observers. From there being so far a resemblance between rickets and mollities ossium, that in both there is softness of bone and deficiency of phosphate of lime, some have supposed them to be the same malady; but they differ so completely from each other in many respects, that it is very evident they ought to be regarded as entirely distinct diseases. Some of the striking points of difference are the following:—Rickets is a very common affection; mollities ossium is so extremely rare, that, in a period of more than thirty years, no example of it occurred in any of the London hospitals. Rickets is by no means a dangerous disease; mollities ossium has invariably proved fatal. Rickets is a disease of early life, and is equally common in both sexes; whereas mollities ossium takes place in the middle period of life, and the great majority of well-marked examples of it that are recorded have been in females. One of the earliest recorded examples of this disease in the male was the case of Jas. Stevenson, who was attacked with it when thirty-five years of age, and after languishing in bed for six years, died in 1785. In rickets, the disease commences while ossification is imperfect, the phosphate of lime never having been deposited to a sufficient extent; mollities ossium takes place after the process of ossification is perfect, and the phosphate of lime, previously deposited, is in a great measure removed. In mollities ossium the urine is loaded with a deposit consisting of phosphate of lime; in rickets there is no such deposit. In mollities ossium the patient complains of pains in the bones, and is distressed with irritative fever; whereas these symptoms are not present in rickets, or, if present, they arise from other constitutional diseases.

Symptoms.—By way of further description of this remarkable disease, I shall state a few particulars of some of the most extraordinary examples on record. The first case I shall mention is that of Ann Elizabeth Queriot, recorded by Dr. Hosty. This person was attacked at the age of thirty-six, soon after the birth of her first child. She was distressed with fever, profuse perspiration, and violent pains in the bones; and the disease was attended with a deposition of a white sediment in the urine. The disease continued about two years, and the bones became so soft that they bent in various directions, and so much distorted that her lower extremities turned upwards so as to lie in a line parallel with her body. After her death the bones were found to be so soft, that they could be easily cut with a knife, and so flexible, that although the extremities had assumed a curved direction, they could easily be laid straight. The cavities of the bones contained a reddish blood-like fluid instead of marrow. No cause could be assigned for the disease, and during its progress she was three times pregnant.

Another remarkable case is that of Madame Supiot. Her disease was attended with great general weakness, fever, pains over the whole body, and a white sediment in the urine. General softening took place in her bones, so that they yielded to the action of the muscles, and the distortion was so complete, that her lower extremities were drawn upwards, and her feet lay by the sides of her head. Her disease lasted five years, during which period she was three times pregnant. For some time before she was attacked with this disease, and for two years afterwards, she was addicted to the habit of eating kitchen salt, and it is stated that she used to take a pound and a half a week without mingling it with her food. To this habit some have attributed her disease; a habit, it may be remarked, to which some others of those who have been subjects of this malady were addicted. After death her bones were found to be soft, sectile, and flexible, and loaded with a bloody fluid.

The chief symptoms are great debility and emaciation; violent persistent pains in all parts of the body, but chiefly in the spine, pelvis, and limbs, greatly aggravated at night, when they become so severe as to cause extreme distress; an overpowering feeling of prostration; loss of firmness and solidity of the osseous system, so that the bones yield to the weight of the body and to the action of the muscles, giving rise to great distortions, and rendering them unfit for the performance of their functions; a swelled condition of epiphyses; and fragility of the bones, in some instances to an extent to give rise to fractures on the application of the slightest exciting cause, the weight of the body on raising the patient, in some cases, being sufficient to produce fracture. The fractures remain ununited, as might be expected, when the condition of the bones is considered. In some examples of this disease the fractures have been very numerous. In Tyrrell's case there were 22, and in Arnott's 31. Rokitansky says,—"Not unfrequently mollities ossium is associated with cancer of the internal organs, a fact which reminds us of the old observation as to the brittleness of the bones in cancer." It usually affects all the bones of the body, but in the majority of cases, those of the head and extremities to a less degree than those of the trunk, and, indeed, in some cases, it has so far confined itself as to proceed to a very great degree in the trunk, while the extremities are affected in a very subordinate degree. On the other hand, Solly has reported two cases in which it was confined to the lower extremities. It is a belief with some, that in general it begins in the pelvis. The urine presents remarkable characters to be afterwards described. The digestive organs are greatly disordered, the mental faculties remain undisturbed, the body becomes extremely distorted, there is manifest constitutional cachexia, and death takes place from exhaustion; but there are great varieties as to the period of its occurrence, being sometimes in a few months, and in many cases not for several years.

Age and Sex.—The favourite period for commencement is between the 30th and 50th years. In instances where the disease was found hereditary through three generations, it never showed itself in any of the offspring until after puberty. It is much more frequent in females than in males, the proportion, according to some, being as 10 to 3.

Morbid Anatomy.—On removing the bones, they are found to be light, flexible, readily made to snap across; they are easily cut through, slight resistance being offered to the knife by gritty particles; they are like the periosteum, of a dark-red injected appearance; the periosteum adheres very loosely; the bone is rarefied and atrophied, and contains a dark reddish-brown grumous fluid, and on compressing the pliant bone, the fluid can be readily squeezed out of it. This fluid is observed, on making a section of the bone, to be contained in circular or oval cavities, and on microscopic examination, Dalrymple found it to consist of granular matter, nucleated cells, and caudate corpuscles, and arrived at the firm belief, therefore, that it is a disease of an essentially malignant nature, but that it differs from other malignant affections. Instead of progressively reproducing and developing themselves without limitation, the new and morbid formations which replace the original and sound structure, seem to have been at an early age of their existence removed by absorption, and carried out of the system. On microscopic examination of the bone, Solly found the Haversian canals immensely enlarged, the osseous corpuscles greatly diminished, and the lamellar structure lost. One of the most remarkable indications is the state of the urine, the whole substance with which it is loaded was found by Solly to be phosphate of lime, absorbed from the bones and eliminated by the kidneys, and he records a case where it formed a renal calculus which filled up the interior of the kidneys. In Macintyre's case, the urine contained an immense quantity of animal matter, with characters different from anything previously described. The following are the characters: "On adding nitric acid to the urine, a slight yellow opacity was the first announcement of a change going on in the mixture; this gradually deepened in tint, with increasing consistency of the fluid, till the whole coagulated into a bright and somewhat resplendent mass, presenting very much the appearance of a heap of nitrate of urea scales, blocking up the tube. It further resembled that substance in liquefying on the application of heat, and again concreting on cooling, but no crystalline arrangement could be perceived, the sparkling appearance being evidently due to numerous air-bubbles entangled in the mass. Perfect redissolution took place when the tube was held for a few minutes in the flame of a spirit-lamp, or plunged into hot water at 160° or 170°, the ordinary coagulating point of albumen; and the fluidity thus acquired persisted under ebullition, however prolonged."

This peculiar and painful disease hitherto has never been cured, and its cause is unknown. It is with the greatest interest I have perused the writings of Rokitansky, Dalrymple, Jones, Macintyre, Curling, Solly, Paget, Stanley, and others, on this disease. The disease, the leading characters of which I have endeavoured to state, is that which has been described by Dalrymple, Jones, and Macintyre, under the name of mollities ossium, and by Rokitansky under the names of osteomalacia, malakosteon, and rhachitismus adultorum. Paget considers this as one of two diseases included under the name of mollities ossium, the other being a condition of the bones described by Hunter, Curling, Solly, himself, and others. Hunter, referring to a specimen of mollities ossium, says, the component parts of the bone were totally altered, the structure being very different from other bones, and wholly composed of a new substance, resembling a species of fatty tumour, and giving the appearance of a spongy bone, deprived of its earth, and soaked in soft fat. This form is admirably described by Curling, and he purposes to give the name "Eccentric Atrophy of Bone," to express one of the principal characters of the disease. Paget in describing the disease says,—"The medulla of the bone had the bright, pink, and deep crimson hues, which are so striking in many instances of the disease." But the constituents of this apparently peculiar material were, free oil in great quantity; crystals of margarine, free, or enclosed in fat-cells; a few fat-cells full of oil as in health, but many more, empty, collapsed, and rolled up in strange and deceptive forms. Paget considers the specimens he has described, as well as those by Hunter, Curling, Howship, and Solly, to constitute a form of mollities ossium, and to consist in fatty degeneration of bone, which, he thinks, will eventually be ascertained to be a result of defective nutrition. The other disease included under the same name, is that to which the descriptions of Rokitansky, Dalrymple, Jones, and Macintyre refer, and which Paget believes to consist essentially in the removal of the earthy matter, and the reduction of the bone to its cartilaginous base. The last-mentioned form is extremely rare in this country, much more so than the fatty degeneration, but it seems to be more common in Germany and France than the fatty degeneration. The fatty degeneration is believed to take place to the greatest extent in the extremities, and the simpler softening in the trunk.

FRAGILITAS OSSIUM.

In this state the animal matter is comparatively less abundant than the earthy. It occurs in old age as a consequence of the change which takes place in the structure of the bones at that advanced period; but it is also met with in middle age, in which case it is symptomatic of some other disease, such as cancer, scurvy, or syphilis: in these states it sometimes prevails to a great degree, and is rarely amenable to treatment.

EXOSTOSIS.

Exostosis is an unnatural enlargement of bone, exhibiting various sizes and shapes. The tumour may involve the whole bone, or it may be confined to a small portion. It may form rounded prominences, which are attached by narrow or broad bases; and sometimes the growth has the form of elongated spines terminating in a point. The increased development of bone may arise from the periosteum, the cellular structure, or from the medullary membrane.

The structure of the tumour resembles ordinary bone, and may be either laminated, cellular, or compact, in its interior. All bones are liable to exostosis, but it more frequently occurs in long bones, particularly in the humerus, femur, and tibia. There may be some constitutional peculiarity favouring this bony deposit, but the predisposing causes are generally syphilis, scrofula, and gout. Violence frequently excites inflammation in the bone, by which the equilibrium between absorption and deposit is destroyed, and the excessive deposit takes place in the manner that bones are originally formed and repaired.

Symptoms.—Generally there is but little pain, in a healthy constitution, unless the tumour presses on parts particularly sensitive; but if syphilis or scrofula be the cause of the disease, there may be a dull, deep-seated pain. Pain is also more likely to be present when the tumour is of rapid growth; but when the growth is slow, there is but little inconvenience, unless it interfere with some important organs. It may press on muscles and impede their action, or it may impede the motion of a joint; when growing from the orbit it may occasion protrusion of the eyeball; or, if from the internal table of the skull, it may cause epilepsy.

Care must be taken to distinguish those tumours which are dependent upon syphilitic or scrofulous taints, from those which are idiopathic, the latter being inconvenient generally from their size and weight, whilst the former may ulcerate and be attended with constitutional disturbances.

Treatment.—If syphilis or scrofula exist, the constitutional remedies employed in these diseases must be mainly relied on; at the same time, pain may be relieved by leeches and anodyne applications. True idiopathic exostosis is generally but little diminished by medical treatment, and if it occasions no inconvenience, it should be let alone; but if it mechanically interferes with the function of any part, it is to be removed. The operation will in a great measure depend upon the size and form of the tumour. If it be spiculated, it may be cut down upon, and removed by bone-pliers or a fine saw; but if it has a large base, it may be chiselled off piecemeal. If it be impossible to reach it with instruments, the periosteum should be scraped away, so as to deprive it of its nutrition, and it may exfoliate or be absorbed. The edges of the wound are to be brought together, and inflammation carefully guarded against.

SPINA VENTOSA.

Spina ventosa is swelling involving the whole circumference of a bone, and of a regular form. It consists of a bony crust, which forms the walls of a cavity divided into compartments, which contain either an ichorous fluid, or a reddish, jelly-like substance; or a cheesy, lardaceous substance, and sometimes pieces of cartilage or of dead bone.

It commences with deep-seated, dull pain, which is often the result of external violence. The swelling gradually increases, the skin becomes red, and the shell bursts, discharging its contents. Sometimes the walls are formed merely of expanded periosteum. After the contents are evacuated, the cavity fills with fungous excrescences, which protrude through the opening, and which are very sensitive and easily bleed.

The disease probably commences in an inflammation and ulceration of the medullary membrane, which constantly enlarges the tubular cavity of the bone, and fills it with foul matter; at the same time there is going on a deposit from the external periosteum, which becomes expanded. At first, it might be mistaken for exostosis; but, in exostosis, the tumour is firm and incompressible, whereas, in spina ventosa, it is a mere osseous shell.

It is a disease of slow progress, and very difficult to cure. On the fingers, or metacarpal bones, long-continued pressure may perhaps effect a cure. At the same time, the patient should take iodide of potassium in large doses. Should the tumour burst, and it is recommended by some to open it, the cavity should be cleansed and injected with stimulating washes.

OSTEO-SARCOMA.

Osteo-sarcoma is a tumour formed upon a bone, but consists not merely of bone, but also of flesh, fat, jelly, and cartilage. It is dependent upon some constitutional vice, either venereal, scrofulous, or gouty, often excited by an external injury.

Boyer considers that it corresponds to the cancerous affection of the soft parts, and that, after its removal by amputation, it will return in other parts of the body.

The tumour becomes large and nodulated, and some parts are firm, and others are soft and elastic. Upon dissection, the muscles and tendons will be found to be expanded, and of a pearly-white colour. The various coverings will be found much matted together, and firmly adherent to the bone. Upon cutting into the bone, it will be found to contain cells filled with medullary or gelatinous matter, intersected with bony spiculæ.

Its growth is attended with severe and lancinating pain. The skin is stretched and then inflamed; finally ulceration occurs, which produces hectic and death.

Treatment.—The treatment in the early stage of the formation is similar to that for exostosis; but amputation will generally be found necessary.

Certain tumours formed upon bone will be found described in the chapter on Tumours.

CHAPTER XII.

DISEASES OF JOINTS.

ACUTE SYNOVITIS.

Anatomical Characters.—The first effects of inflammation of a synovial membrane are, that the membrane, instead of being pale, thin, smooth, and translucent, as in the sound state, becomes red, preternaturally turgid and opaque, with dulness of its surface. The redness depends on increased vascularity, and may present the appearance of crimson or brownish spots, or it may be diffused over the membrane. There is at the same time a preternatural secretion of synovia, which is of a more aqueous character than in the healthy state, and of a less albuminous quality. As the inflammation advances, other changes take place both in the membrane and in the fluid. The membrane becomes considerably thickened by interstitial exudation; it has some degree of pulpiness with redness, and entirely loses its translucency. The absence of the natural smooth glistening appearance is more decidedly observed on its internal surface, to which lymph is often found adherent, giving it a rough appearance; and if the inflammation be of considerable standing, the lymph may be effused not only on its internal surface, so as to make that surface irregular, and into the substance of the tissue, giving rise to thickening, but also into the cellular tissue external to the membrane, and by which it is connected with the surrounding parts. The membrane at this stage is much distended with a fluid of a serous character, having albuminous or curdy flakes floating in it, and hence called sero-albuminous. This is the stage at which adhesion of opposite sides of the membrane may take place, but such an occurrence is comparatively rare, partly in consequence of the great distension from synovia, and partly from tendency of the inflammation to increase. At a more advanced period the internal surface is more extensively covered by lymph, which becomes in a measure organized, and forms a secreting surface. There are great varieties as to the extent and thickness of the effused lymph, and also of the appearance of its free surface. In many instances it covers the whole of the synovial membrane, so that no part of it can be seen on laying open the joint; in some it is comparatively thin, and in others it forms thick projecting masses. These varieties occasion also a great difference with regard to the surface of the cavity of the joint, which thus exhibits a greater or less degree of irregularity. The adventitious tissue, as it has been called, becomes organized, and secretes purulent matter into the joint, giving rise to great distension. At this stage the articulation may be regarded as forming an acute abscess; and if the synovitis should run its course, the matter may sooner or later point, making its way to the surface by interstitial absorption and ulceration, and at length be discharged by ulcerated openings; an event which, though it gives temporary relief, is soon followed by a decided aggravation, much more frequently than by a diminution of the inflammatory action. From the extension of the inflammation to the cellular tissue around the joint, lymph and serum are deposited in it, and, in consequence, a doughy and œdematous swelling becomes perceptible between the skin and the distended cavity of the articulation. Destruction of a portion of the membrane and subjacent cartilage, and caries of the bone, are frequent results of acute as well as of chronic synovitis.

The above are the principal results of acute synovitis in unfavourable cases, where the inflammation attains a high grade; but sometimes the inflammation terminates at an early stage in resolution, and thus structural derangement is prevented; sometimes it goes on to the effusion of lymph, and produces adhesion, to a certain extent, of the opposite surfaces of the membrane to each other, admitting ultimately a limited motion of the joint, but such adhesions, as has been already stated, are rare; and sometimes when the inflammation has attained a higher grade and produced suppuration, and the matter has been discharged, although such cases generally produce, at length, a total disorganization of the joint, they may terminate in anchylosis.

Symptoms.—This disease, very rare in the child, and less uncommon in youth, is most frequently met with in the adult. The knee, ankle, and elbow are more liable to it than the other articulations, but it is most common in the knee. The first symptom experienced by the patient is *pain*, which though slight perhaps at first, gradually increases, and soon becomes very severe. It may be more intense at a particular part, but it is usually felt over the whole of the articulation; it is aggravated by motion, which is always injurious and often intolerable, and generally by cold, and by the extended position; it is diminished by rest, by heat, and by slightly bending the joint, and thereby relaxing the structures; hence the patient has an inclination to maintain the parts in this attitude. Almost synchronous with the pain is *swelling*, which at first depends entirely on the distension of the membrane by synovia. It is as uniform as the ligaments and tendons surrounding the joint will permit, being prominent where the synovial membrane is not confined by these structures. The swelling has very distinct fluctuation; and if the joint be superficially situated, this peculiarity is very evident; and even the fact of its being caused by a very thin fluid is discernible, and thus an impression is conveyed of the stage as well as of the nature of the disease. As the disease advances, the swelling is caused partly by serous and albuminous effusion into the cellular tissue external to the synovial membrane, but chiefly by distension from the fluid within, which ultimately changes so as to become purulent. The serous and albuminous effusions cause the swelling to feel somewhat œdematous and doughy; and though the fluctuation be still perceptible, it is more difficult, from the examination alone, to form an accurate and decided opinion, in every instance, as to the nature of the fluid within the joint.

Motion of the joint is not only difficult, but painful, and often attended with a grating sensation, which is supposed by some to be caused at an early period by the change in the character of the synovia, which becoming more aqueous and consequently less lubricating than in a healthy state, is less calculated to diminish the effects of friction. Whether this supposition may or may not be in part correct, it seems more likely that even at first this symptom depends very much on the swollen state of the membrane; and at a more advanced period the impression forced on a careful examiner is, that it arises from the irregularity on the surface of the lining membrane. The parts external to the synovial membrane being involved in a low degree of inflammation, the skin is preternaturally sensitive, red, tense, and hot. The pain is increased on pressure, and the patient maintains the joint in a slightly flexed position. In many instances, the muscles of the limb are affected at times, and especially during sleep, with spasmodic twitches, which aggravate the symptoms; and the rigidity of the muscles, particularly of the flexors, which maintain the joint slightly flexed, is preternaturally increased, and their bellies and tendons may in consequence be felt unusually tense under the common integument.

The severity of the constitutional symptoms varies considerably according to the violence and extent of the inflammation, the grade in which it exists, and the peculiar constitution of the patient. At first the usual symptoms of inflammatory fever appear more or less distinctly marked, but they become more severe, as the disease advances to a higher grade. When the inflammation reaches the suppurating stage, there are frequently rigors, together with a marked aggravation of the symptoms. If the matter be discharged, there is often a diminution of the symptoms, but this is usually of very short duration; and sooner or later the symptoms of inflammatory, are changed into those of hectic, fever, under which the patient will sink, unless the disease be arrested, or the joint removed.

Causes.—The predisposing causes, which also, to a certain extent, modify the character of the attack, are rheumatism, scrofula, syphilis, and the use of mercury; and so powerfully do these conditions operate, that where they exist, a very slight exciting cause, such as a bruise, a sprain, exposure to cold, a wound, or any injury near a joint, is sufficient to induce the disease; and, indeed, it occasionally comes on without any known exciting cause. The most frequent exciting cause, however, is cold, combined with damp, which is more apt to affect the more exposed articulations, as the knee, ankle, and elbow. Synovitis frequently takes place in the progress of diffuse suppurative phlebitis, and it is well known that in persons of rheumatic constitution, inflammation of the synovial membrane of various joints is occasionally produced by the excitement caused by gonorrhœa.

Treatment.—This is both general and local; the former consists of the early and decided employment of the antiphlogistic regimen and treatment in all their details. When the general system is affected with high inflammatory fever, bloodletting should be employed to an extent proportioned to the age and strength of the patient, and the violence of the disease. The bowels should occasionally be smartly purged; but the frequent employment of cathartic medicines is not advisable, as it would interfere with a most important indication, namely, to keep the affected joint at perfect rest. When the disease is not speedily arrested, it is of the utmost importance for checking the diseased action, and thereby preventing structural derangement, and for preserving the joint in a fit state for the future performance of its function, to bring the system under the influence of mercury. With this view calomel and opium are prescribed with advantage. When circumstances render it injudicious to have recourse to mercury, much benefit is often experienced from the use of the tartrate of antimony, and in persons of a rheumatic diathesis the exhibition of colchicum, to an extent sufficient to produce in some degree its peculiar effects on the system, usually leads to the happiest results. Such are the principal remedies, as far as regards constitutional treatment in acute synovitis; and they ought to be employed at an early period, and to be carried to as great an extent as may seem necessary and judicious, so as to prevent, if possible, the occurrence of structural derangement.

As regards local treatment, one of the most important indications is to keep the joint at perfect rest. The state of complete repose must be strictly enjoined not only during the acute stage, when in consequence of the pain caused by motion the patient has little inclination to move it, but also till all inflammatory action has subsided; for when the inflammation has become chronic the symptoms are invariably aggravated after motion, although pain may not be felt at the time; and it cannot be doubted that extensive disorganization has often resulted, and many a limb has been lost, from prematurely and imprudently resuming motion. The attitude in which a joint should be kept at rest, must vary according to the situation of the joint; but it may be given as a general rule, that it should be maintained as nearly as possible in that position in which it will be most serviceable and convenient, provided the joint remains stiff, or with great limitation of its motion. The means to be employed for preserving the joint at rest may vary. The limb may be gently bound in the acute stage to a pillow, but a gutta-percha, or some nicely padded suitable splint, is the best appliance for fulfilling the essential indication of preserving the joint at perfect rest. Local depletion is important, either by leeches or cupping, or, which is often found to answer very well, first by the former, and afterwards by the latter. The efficient application either of cold by means of evaporating lotions, or of heat with moisture by poultices or fomentations will be found useful : in making the choice between these two applications, heat and cold, the best guide will be the patient's feelings; for whichever is most grateful to the feelings will be most beneficial. By the judicious and early employment of the above constitutional and local treatment the inflammatory action is in many instances subdued; and with the continuance of the antiphlogistic regimen and rest of the joint, its effects disappear; and then by gradual and cautious trials the functions of the articulation may be resumed. If, however, the inflammation does not yield under the above treatment, though carried to as great an extent as prudence will allow, it is advisable to employ some of the forms of counter-irritation, of which one of the most efficient is that of blisters. But it is important that care be taken never to apply a blister over a joint in acute synovitis, unless the joint be deeply seated, or the inflammation has become chronic, and depletion has preceded the application. The inflammation would probably be increased by a blister applied over a joint superficially situated, the disease in the acute stage being so susceptible of aggravation, and there not being room, as when the joint is deeply seated, for the blister to act on the principle of derivation. If it is ascertained beyond all doubt that suppuration has taken place, it is advisable to discharge the matter as in other acute abscesses by free direct dependent incision ; but as nothing could be more injudicious than to make an opening into a joint distended with serous or even seropurulent effusion, the evidence of suppuration should be very clear. If any doubt remain, the nature of the fluid may be ascertained by the introduction of a grooved needle. After such an opening and the discharge of the matter, an attempt should be made to obtain anchylosis, and for this end, rest of the joint and attention to all means likely to improve the general health are essential ; but as might be anticipated, although frequently successful, our hopes are often disappointed, and too generally it becomes needful to remove the limb, in order to preserve the patient from sinking under the accompanying hectic fever.

CHRONIC SYNOVITIS.

Chronic synovitis most frequently occurs in persons who have been affected with syphilis or mercury, or who are of a rheumatic diathesis: it is, however, occasionally met with in others also. It is frequently excited by that kind of injury termed a sprain, or by any local mechanical injury, as a blow or a contusion, or by exposure to cold and damp. In many instances it is the form of perverted action, ultimately assumed in cases which were originally acute.

Anatomical Characters.—The synovial membrane becomes opaque, thick, and pulpy, and preternaturally vascular; and its free surface, instead of being smooth, becomes villous, or granular; and the cavity of the joint is filled with a fluid which at first is serous, but ultimately by mingling with a puriform secretion becomes sero-purulent; or, from the absorption of the thinner part, entirely purulent. For a considerable period, the changes are confined to the membrane and its contents, and hence arises the difference in the superimposed parts during the early stages of acute and chronic synovitis; but by a continuation of the morbid action, or by the intervention of an acute attack, the extra-capsular filamentous tissue becomes affected, and infiltrated with a jelly-like substance, and the membrane may ulcerate and the cartilage be destroyed by ulceration; and this may be followed by destruction of a portion of the bone and the total disorganization of the joint.

Symptoms.—If the disease be chronic from the commencement, the early symptoms will differ from those of acute synovitis. There will be no redness of the skin, no particular heat, nor will the pain be very acute, nor much aggravated at the time by motion. On this account patients have not the same dread of moving the joint as in acute inflammation; but it is no less necessary to preserve it at complete rest, as motion is followed by an increase of the symptoms. The pain is not only less severe, but is felt more at a particular part than over all the articulation. Swelling takes place in the course of a short time, but not so soon as in the acute form; it is not uniform, but bulges out, principally in parts where the synovial membrane is not confined by ligaments or tendons; and as the superimposed tissues are not in the first instance involved, fluctuation is exceedingly distinct. In some instances, from the thickening of the membrane itself, and the depositions into the superimposed tissue, which take place during the progress of the disease, the swelling has to a certain extent a doughy or elastic character, and the fluctuation becomes more obscure; but still, on careful examination, it can always be discerned. The motion of the joint is followed by pain; the inclination of the patient is to preserve it more or less flexed, and the flexor muscles are found to be tense, the others flabby and relaxed. If the disease be of long continuance, the swelling of the joint becomes very great; and presents a striking contrast to the rest of the limb, which is often greatly emaciated from interstitial absorption of all the structures, both hard and soft. Frequently the veins over the joint are greatly distended, and the skin from its wrinkles being unfolded by the tension, has a shining appearance. If the disease run its course, the matter may point at a particular part, and make its way to the surface by interstitial absorption and ulceration.

In some instances, the disease is chronic from the very commencement, in others, it is at first acute and afterwards chronic. In some, the symptoms continue chronic throughout, and in others, they are for the most part chronic, but with occasional aggravation from accession of acute symptoms. If the symptoms have been chronic from the commencement, the patient may not have experienced any inflammatory fever; whereas, if the disease was at first acute, the signs of inflammatory fever are exhibited while the acute stage continues. The constitutional disturbance, however, which sooner or later takes place in every instance where the disease does not come to a favourable termination, is the accession of hectic fever, which will prove fatal unless the joint be removed.

Treatment.—As regards the constitutional treatment, which is of very great importance, it may be said that in the absence of any peculiar cachexy, the chief points are to enjoin the antiphlogistic regimen, to regulate the bowels, to preserve the digestive apparatus, if possible, in a proper state for the performance of its functions, and to adopt all prudent measures for maintaining the general health. When hectic fever supervenes, the strength should be kept up as much as possible by nourishing diet, and such tonic remedies and other means, as seem most suitable to the particular circumstances of the case. When the disease arises from syphilis, a well-regulated course of mercury is necessary; when from rheumatism, the vinum colchici will prove highly beneficial; and when from the abuse of mercury, or from injudicious exposure during or after a mercurial course, the happiest effects often result from the use of sarsaparilla, combined with the iodide of potassium. In cases especially where synovitis is combined with inflammation of the periosteum, the last-mentioned remedies are often highly beneficial.

With regard to local treatment, in this as in all cases where joints are diseased, it is most essential that rest be observed; if this be neglected, all other means will be of no avail. Local depletion by leeches or cupping—the latter being generally preferable in chronic synovitis—will be found advantageous in the early stage, not only for checking the inflammation, but also for rendering it safe to employ counter-irritation. At the same early period the efficient application of cold is usually grateful to the feelings of the patient, and beneficial. But one of the most valuable remedies, both for subduing the inflammation, and also for promoting the removal of its effects, is counter-irritation, which will be most efficiently employed by the repeated application of blisters in the immediate neighbourhood rather than directly over a joint, unless it be deep seated.

These are the principal remedies on which reliance can be placed for checking chronic synovitis. The treatment, therefore, may be said, in the first instance, to consist in the employment of rest, local depletion, cold applications, and counter-irritation by means of blisters. At a much later period, when the inflammation is considerably subdued, benefit is often derived from some of the other forms of counter-irritation. Some of the principal applications for this purpose are, small caustic issues, or the application of the moxa, in the proximity of the joint. Other excellent modes of employing counter-irritation are painting the joint with the tincture of iodine, or brushing it over with a strong solution of the nitrate of silver, or, after having damped the skin with water, rubbing it very gently with the solid nitrate. These applications must be used with caution, and the surgeon must watch against recurrence of acute inflammatory action; and to diminish that risk, it is prudent to delay the employment of some of the forms of counter-irritation until the acute inflammation has been in great measure subdued.

Under the above treatment the inflammation and its effects may disappear, and in the course of time, by passive motion and friction, the motion of the joint may be restored, and the patient allowed to use the limb. Often, however, there remains a stiffness of the joint from the thickening of the soft tissues, sometimes hydrops articuli; for the removal of which the following treatment is recommended:—

Stiffness from Thickening of the Soft Tissues.—The principal remedies are, the repeated application of blisters, so often beneficial from their well-known effect in promoting absorption; pressure by means of a roller with or without some discutient ointment; friction by the hand with some dry powder; warm water poured on the joint, which is useful not only from the relaxing effect of the heat combined with moisture, but also by causing friction, especially if it be poured from a considerable height; the vapour bath, together with shampooing in the bath, and passive motion. Whenever rubbing, shampooing, or friction is employed, the effects must be carefully watched; and if the treatment should be observed to excite any inflammation, it must be immediately discontinued. Of course nothing could be more injudicious than to have recourse to rubbing, friction, pressure, or motion, while any inflammatory action remains.

Hydrops articuli is the name given to that condition in which a joint remains distended with synovia, but without pain, redness, or any other symptom than the swelling, and the sense of fulness, and often of weakness, which it occasions. After the subsidence of the inflammation, the fluid is in most instances absorbed spontaneously. When, however, this does not take place, the principal means adopted for promoting absorption are, rubbing the joint with the camphorated mercurial ointment, or with the ointment of the iodide of potassium, along with the internal use of the iodide of potassium; or gentle pressure by means of a roller, or pressure accompanied by the rubbing of the joint with the iodide of potassium ointment. In most cases, these means produce absorption very speedily. Among other successful methods of treatment, the repeated application of blisters directly over the joint, if it be deeply seated, or in the immediate neighbourhood, if it be superficial, and pencilling the joint with the tincture of iodine, with or without its internal use, deserve to be mentioned. In some cases, local acupuncture has been resorted to, either as a preliminary step to drawing off the fluid by means of the exhausted cupping-glasses; or with a view to allow the fluid to escape into the surrounding tissue, so as to convert the case into one of diffuse œdema. But this procedure, if any inflammation whatever remain about the joint, will be of no avail in accomplishing a cure, since the fluid will be very quickly secreted again; and if there be no inflammation, it is unnecessary, inasmuch as the disease usually yields to some of the less hazardous methods already mentioned; but if, after the employment of other means, the disease should still persist, when it is remembered that the puncturing of a joint is by no means free from the risk of exciting a fresh inflammatory attack, it does appear a matter of very doubtful propriety to recommend, for the removal of an inconvenience, a procedure which, though it has doubtless been frequently adopted without such a result, may possibly excite a serious inflammation. Velpeau and Jobert of Paris, and Bonnet of Lyons, have resorted to injection of the joint with tincture of iodine for the cure of hydrops articuli. The proceeding adopted by these surgeons consists in puncturing the joint with a trocar and canules, drawing off a portion of the fluid, but not the whole of it, throwing in a corresponding quantity of an injection composed of one part of tincture of iodine to two or three parts of water, pressing the joint gently during the sojourn of the injection, so as to secure contact with every part, and after two or three minutes allowing the whole of the fluid to escape and carefully closing the wound. The supervening inflammation is then treated by the ordinary remedies; and these French surgeons state most decidedly that several cases have been perfectly cured without anchylosis, and that in no instance has the treatment given rise to serious or dangerous consequences. It is quite certain, however, that other surgeons have seen cases in which this treatment gave rise to inflammation which endangered both life and limb, and the dread of uncontrollable inflammation has hitherto prevented surgeons in these islands from venturing on this proceeding—a proceeding which, apart altogether from the question of whether or not it be justifiable on account of the danger of a wound of a joint, is really not necessary, as these cases always get well unless there be disorganization of the synovial membrane.

After removal of the disease, cold douches and the use of an elastic bandage are useful and grateful to the patient until the strength of the joint is completely restored.

SCROFULOUS CHRONIC SYNOVITIS.

This disease, called by some authors the gelatinous degeneration of the synovial membrane, is sometimes attributed to a slight injury, as a bruise or sprain; but it often presents itself without any assignable exciting cause. It is most frequently met with during adolescence, though, certainly, it is not confined to that period. The subjects of it are always of a scrofulous habit; and it is not only accompanied, but also preceded, in most instances, by the symptoms of scrofulous cachexy.

Symptoms.—One of the first symptoms is, swelling about the joint, which slowly advances, and is of a doughy, elastic nature; but which cannot be said to be characterized by distinct fluctuation. This disease is recognised as much by its negative as by its positive symptoms, and is remarkable for the length of time the skin retains its natural appearance. There is little or no pain, scarcely any tenderness on pressure, and at this stage none of the local symptoms of inflammation, except swelling, which, with stiffness or diminished mobility and a sense of weakness, are the only local signs of the disease. In the further progress of the disease the swelling continues to enlarge, and the rest of the limb becomes wasted. After continuing for months, and often for a longer period, the disease either changes favourably and the swelling diminishes, or it goes on to suppuration of the joint, attended with great aggravation both of the local symptoms and of those of the scrofulous cachexy, and ending in the destruction of portions of the cartilages and bones; and unless some of the forms of anchylosis should occur, which after this stage of the disease is an exceedingly rare event, the only chance of saving the patient's life will be the removal of the affected part.

State of the parts.—It the case of a young man, who was the subject of this disease in the knee, and who died of phthisis, I had an opportunity, at a post-mortem examination, of making a dissection of the joint. I found the synovial membrane thickened, of a gelatinous appearance, of a greyish-white colour, and at some parts considerably injected; the synovial fluid was flaky and much more opaque than is natural; and there was an effusion of a gelatinous character into the cellular tissue, so that it was thickened; and the skin, the synovial membrane, the cellular tissue, and the ligaments were all matted together. In another example of this disease in the knee, I some time ago had occasion to perform amputation, and found the same morbid alterations of structure as in the last-mentioned case, and the same matting together of tissues, with the additional peculiarities that the membrane was much more injected; the part of it which covers the cartilages of the femur was destroyed; the cartilages were removed; the extremity of the femur was carious; and the fluid in the joint was scro-purulent.

Treatment.—Since this disease is connected with scrofula, the treatment adapted to that particular state of the constitution is, during the whole of its progress, indispensable; and, however necessary local treatment may be, it is equally important, if not much more so, to employ such means as are calculated to operate favourably on the general system. For an account of the treatment proper for the scrofulous diathesis the reader is referred to the chapter on Tubercle. The local treatment is nearly the same as in simple chronic synovitis; but with reference to local depletion, there are two considerations which will prevent the surgeon from prescribing it, except so far as is absolutely necessary; the one, that it has much less effect in controlling scrofulous than common inflammation; the other, that free depletion is very unfavourable to the state of the general system. The treatment may be stated to consist—in preserving the joint at perfect rest through the entire continuance of the disease; in endeavouring to arrest acute inflammation when it occurs, by rest, cold applications, and local depletion, the last being employed as sparingly as possible; in attempting to subdue inflammation when more chronic, by rest and counter-irritation, slight depletion, as in simple chronic synovitis, preceding the application of the counter-irritants; and after the inflammation has been subdued, in employing means for fulfilling these three indications, namely, to keep the joint at rest, to apply pressure in order to promote absorption, and to use some of the most efficient applications for stimulating the absorbents. These three indications can be effectively combined by Scott's treatment, which "consists in cleansing the surface of the joint with a sponge, soft brown soap, and warm water, and then thoroughly drying it. The part is then rubbed with a sponge soaked in camphorated spirit of wine, and afterwards covered with cerate made with equal parts of ceratum saponis and the ung. hydr. fort. cum camphorâ. This is thickly spread on large square pieces of lint, applied entirely round the joint, and supported with broad strips of the emplastrum plumbi. Over these straps is placed an additional covering of emplastrum saponis, spread on thick leather and cut into four broad pieces, one for each side of the joint. Lastly, the whole is secured with a calico bandage, which is not to be applied so as to cause any uneasiness from pressure." In this, and in some other affections of joints, the above treatment is often instituted with the happiest results; but it must always be employed with the greatest caution, and its effects constantly watched; otherwise very serious consequences may result. It ought never to be adopted while any inflammation exists. The pressure should at first be slight, and gradually increased at subsequent dressings; and even while it appears to be attended with benefit, the symptoms must be most carefully observed, so that, if there should, from any circumstance, be a recurrence of inflammation, however slight, the dressings may be immediately removed, as the pressure would be exceedingly injurious. These are the principal precautions, and it is important that they be not neglected.

Another excellent method of fulfilling the same three indications is,—to excite absorption by applying pieces of lint covered with ung. hydr. fort. cum camphorâ, or equal parts of that ointment, and the ointment of the iodide of potassium; to produce pressure by an elastic cotton roller; and to preserve the joint at rest by a leather or wooden splint retained by suitable retentive appliances.

This method I have often employed with advantage; and it has the recommendation, that the dressings can be removed without any trouble, as often as the surgeon wishes to see the appearance of the joint. If, unfortunately, suppuration should take place, the matter must be discharged, and the treatment formerly mentioned as proper under such circumstances strictly enjoined. If the desired result should not thus be obtained, but the patient be in danger of sinking under the continued irritation and discharge, the local disease must be removed either by excision of the joint, or amputation of the limb.

I have been at great pains, and have spent a considerable sum of money, for the purpose of arriving at a correct conclusion as to the curability of this disease of the joints; and the firm belief at which I have arrived is, that in the event of the disease not being so far advanced as to have given rise to disorganization of the joint, almost every case is perfectly curable, on the expenditure of a sufficient amount of money in procuring the use of proper remedies. I have taken a great interest in this class of cases for many years, and have been long in the practice of treating some at my own expense, among the poor, and have not a stronger belief on almost any surgical subject than on this, that unless total, or very extensive disorganization of the joint has taken place, most cases, however unpromising, are curable. The treatment, from the use of which I have seen such gratifying results, consists in residence in the country, in a dry, bracing atmosphere, with much exposure in the open air to the light of the sun; in maintaining the atmosphere in the patient's room perfectly pure by day and by night; in sleeping in a room in which there is free admission of the light of the sun during a reasonable portion of each day; in guarding against anything which could cause any impurity of the atmosphere; in sleeping on a bed so arranged as to allow free circulation of air around the patient, and as much exposure to the light as possible; in the daily use of animal food, cream, and cod-liver oil, along with some of the preparations of iron; in maintaining a healthy condition of the skin by the means proper for that purpose; in watching the condition of the digestive organs and maintaining them in a vigorous state, and, if necessary, giving some alkaline preparation to correct the acidity of stomach, which is so injurious in the scrofulous diathesis, and so certain, in the way explained in the chapter on Tubercle, to keep up the error in the constitution of the blood, which constitutes so great a part of the scrofulous diathesis.

These means, along with cheerfulness, mental occupation, encouragement, and suitable local treatment, certainly lead in most unpromising cases, with very few exceptions, to the best results that can be desired. It is exceedingly important to encourage the patient, and to produce a firm conviction that benefit will result from treatment. I was much struck with the manner in which this was expressed to me by a patient some years ago. The patient was a female who had a bad knee; she had made up her mind to allow it to be removed, and as it was a very unpromising case, I thought it an excellent one for testing the usefulness of the above-mentioned treatment. I got the treatment instituted to the utmost extent I could desire; the knee got perfectly well, and when the woman, who, I have no doubt, was a sincere Christian, called on me to thank me for the great interest I had taken in her case, she remarked: "I find medicine, like the Gospel, must be received in perfect faith, to get the full benefit of it; I had such comfort and pleasure in following all your directions, even at my worst, because I felt sure they would do me good, as you were always so confident that I should get better." The reason why so many poor people lose their limbs from this disease is, that their poverty renders them unable to place themselves in circumstances to obtain the remedies essential for cure. I have often thought it a matter of the deepest regret that persons, who leave much for benevolent purposes, seem not aware how beneficially funds might be appropriated, if left for maintaining and treating in the country, in healthy situations, hundreds of the poor of our towns who are constantly dying or losing limbs from the effects of scrofula.

THICKENING, WITH MORBID ALTERATION OF STRUCTURE, OR BROWN INTRACTABLE DEGENERATION OF THE SYNOVIAL MEMBRANE.

This disease, sometimes called the pulpy thickening of the synovial membrane, is characterized by certain marks or appearances, not found in any other disease of the joints. The synovial membrane is converted into a pulpy substance of a brownish, or reddish-brown colour, and of a thickness usually varying from a line to half an inch, but sometimes even exceeding an inch. This substance is not of uniform consistence, but is intersected in various directions by a kind of fibrous bands.

The disease generally commences in the reflected portions of the synovial membrane, and most frequently occurs in the knee-joint; but Hodgson met with one example of it in the ankle-joint, and with another in one of the phalangeal articulations of the fingers. I have in my possession an uncommonly well-marked example of this disease affecting the synovial membrane of the shoulder-joint, which I took from a male subject brought to the anatomical rooms of this University, when I taught anatomy. As at that time subjects were procured by exhumation, I found it impossible to obtain a history of the case. The whole of the synovial membrane is more or less affected; at some parts it is about two lines in thickness, in others more than half an inch. It is of a light brown colour on its articular surface, and of a pulpy appearance, with firm intersections of a fibrous consistence. The cartilages covering the bones seem to be entire; the joint contained a thick opaque fluid, apparently synovia, mixed with pus. No other joints than those already mentioned have hitherto been found affected with this disease. It occurs principally in young persons, and in adults; but is so exceedingly rare after the middle period of life, that Brodie has met with only one example. If allowed to run its course, it may terminate either in suppurative inflammation followed by ulceration and complete destruction of the joint, or in malignant tumour. In a beautiful specimen of this disease, affecting the synovial membrane of the knee-joint, which I took from a boy named Bisset, in whose case I found it necessary to perform amputation, the whole of the synovial membrane was affected, except the portion which is behind the patella; but the parts covering the articular cartilages of the femur and tibia were much less affected than that which is situated round the circumference of the joint, where it was in some parts an inch in thickness, and projected into the cavity of the articulation. The articular surface was of a very pale brown colour; and the structure, when cut into, had a pulpy appearance, with white intersections of a fibrous consistence, and very much resembling those of carcinoma. At some few spots there were one or two injected vessels, but no vascular or other marks of inflammation could be discovered on the most careful examination; and the impression conveyed to me, and also to some friends well-qualified to judge was, that the change of structure was the result of some other process than inflammation. The ligaments were entire, and the joint contained a ropy fluid.

It is remarked by Brodie, to whom we are indebted for first pointing out this particular disease, that, "It would add much to the utility of researches in morbid anatomy, if it were more frequently attempted to ascertain, what is the first change in the organization of the affected part which disease produces, and from thence to trace the gradual progress of the other changes which take place, until the destruction of the natural organization is completed." It is the opinion of Brodie, that this disease belongs to the same order as scirrhus of the breast, the medullary sarcoma or fungus hæmatodes of the testicle, and numerous other diseases in which the natural structure of the affected organ is destroyed, and a new and different organ formed in its place, and that although in its progress inflammation comes on, the degeneration into pulpy substance with fibrous intersections is not a result of common inflammation, but of a different kind of morbid action. Some surgeons consider the change of structure to be the result of a chronic form of inflammation. I have not seen a sufficient number of specimens at an early period of the disease to enable me to form a decided judgment; but those which I have seen, and especially the example of it in the knee-joint described above, leave no doubt in my mind that the opinion of Brodie is correct.

Symptoms.—Stiffness, accompanied with a sense of weakness not amounting to pain, first engages the attention of the patient; and as the disease advances, pain comes on, but is usually for a long time inconsiderable, and is increased by exercise. Swelling is soon perceptible, which has a doughy, elastic feeling without fluctuation, and is irregular in shape. This elastic feeling is often very deceptive, and it is only after a very careful examination, under such circumstances, that the surgeon can satisfy himself of the absence of fluctuation. The stiffness gradually increases, and although in some instances a certain degree of mobility is retained, the joint in the great majority of cases at length scarcely admits of any motion. With enlargement of the joint there is also wasting of the limb. The disease begins very gradually, and for a long time its progress is slow; but when it reaches its advanced stages, the pain is often very great, and then its onwards course is generally rapid. The disease, as has been already stated, may terminate either, as it usually does, in suppurative inflammation followed by total destruction of the joint, or in malignant tumour, which, however, is comparatively rare. In the former case, there will be the local and constitutional symptoms of suppurative inflammation; in the latter, the articulation becomes much swollen, and communicates to the finger a sensation as if greatly distended with fluid; the skin becomes tense, glistening, and prominently marked by dilated tortuous veins; the pain is severe and shooting, and attended with a sense of great weight; if an incision is made, blood only escapes, and the disease is now evidently of a malignant nature. For a considerable time constitutional symptoms are not very distinctly marked; but a modified form of hectic supervenes, which, however, becomes much more urgent, when the suppurative crisis arrives. The patient becomes sallow, greatly emaciated, debilitated, and dispirited, and shows the usual symptoms of the cachexy attendant on malignant disease.

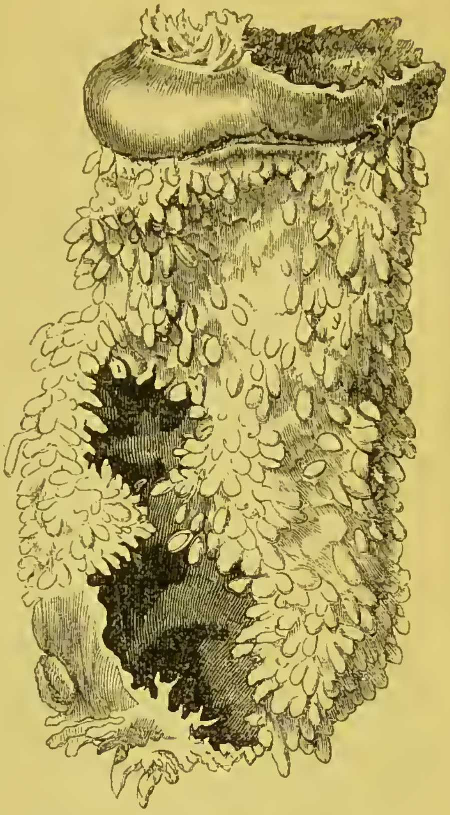
Treatment.—As we are not acquainted with any treatment by which the natural structure of any organ after being entirely changed can be restored, a knowledge of the state of the parts would lead us to the conclusion, which the present state of our experience may be said to authorize, that this disease is incurable. In its early stage it may be somewhat palliated, and its progress rendered less rapid, by means of rest, attention to the general health, and cold lotions; and the pain attendant on the suppurative crisis and the destruction of the cartilages may be considerably diminished by warm applications; and thus a certain degree of relief may be obtained. Sir B. Brodie, after referring to the partial benefit derived from this treatment, says, "But no method, with which I am acquainted, is capable of doing more than somewhat checking the progress, and somewhat relieving the symptoms of the complaint. In every case of which I have had an opportunity of seeing the termination, the ulceration of the cartilages, the formation of abscesses in the cavity of the joint, and the consequent disturbance of the patient's general health, have ultimately rendered the amputation of the limb necessary, in order to preserve the patient's life. At this period, therefore, the surgeon is called upon to recommend and urge an operation; but at an earlier period it is a matter of choice with the patient, whether he will live with the incumbrance of a useless limb till the advanced stage of the disease renders its removal indispensable, or whether he will submit to the loss of it, before the absolute necessity for losing it exists." If amputation be deferred until the disease result in a malignant tumour, it will then be too late to derive from it any further benefit than the doubtful chance of merely, for a short time, deferring the fatal termination. Some surgeons seem to think that at an early stage the disease may be cured, and they speak favourably of the result of treatment similar to that recommended for scrofulous synovitis. For my own part, having found it necessary to amputate in every instance which has come under my observation, I agree with Sir B. Brodie in considering it incurable.

FIMBRIATED SYNOVIAL MEMBRANE.

In this disease the free surface of the synovial membrane is studded over with innumerable bodies termed fimbriæ, of a white or yellowish white colour, and usually varying in size from a millet to a common pea; but some are found resembling, both in size and appearance, the appendices epiploicæ of the large intestines. They are smooth and uniform in their outline, and of a glistening appearance, as if invested with a capsule of the synovial membrane. They are sometimes broad, sometimes constricted in their base, and connected with the synovial membrane by a narrow pedicle. In some cases, these bodies pervade the whole articulation; in others, they merely fringe the synovial membrane. They usually have the appearance of being formed of a capsule of the synovial membrane filled with a fatty substance, and occasionally they have somewhat of a cartilaginous consistence.

This being a very rare disease of the synovial membrane, little is as yet understood either of its causes, or of the nature of the morbid action by which the change of structure is produced. The view taken by Rokitansky of this adventitious growth is, that it is that form of lipoma which Johann Müller has distinguished by the name of lipoma arborescens — a branch growth of fatty tissue in the free part; or in the duplicatures of synovial membranes: it occurs chiefly in the knee-joint. I have seen one specimen of it in the museum of the University of Edinburgh, and three most beautiful specimens in the museum of St. George's Hospital, London; of one of the best of which Mr. Hewit kindly allowed an artist to take a drawing for me, a copy of which is here given.

Fig. 141.



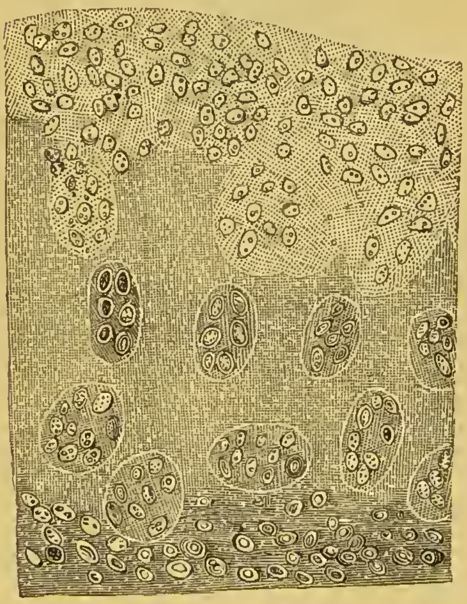
Symptoms.—Pain during and after exercise, and a grating sensation on moving the articulatory surfaces of the bones on each other. The joint becomes swollen and elastic, with stiffness and more or less limitation of its motion. There are no diagnostic symptoms, and those which are present are altogether of a mechanical character.

DESTRUCTION OF ARTICULAR CARTILAGE.

Destruction of the substance of cartilage may take place without the slightest trace of disease in other structures, and as the result of actions confined to the cartilage itself; in which circumstances it is said to be *original* or *primary;* or, it may be the consequence of acute, chronic, or scrofulous synovitis, or of inflammation of the portion of bone to which the cartilage adheres, or of scrofulous degeneration of the joint-ends of bone; when it is called *secondary.* The destruction may thus be either original or secondary; it may be extremely rapid or very slow, constituting acute or chronic destruction; it may be limited or extensive; it may be superficial and limited, or superficial and extensive, or it may go through the whole thickness of part of the cartilage, and thus penetrate to the bone. Though it most frequently commences on the free surface, it may commence in the middle of the substance of the cartilage, or, if it proceed from disease of the bone, on the attached surface. It may be unattended with the slightest vestige of disease of the synovial membrane or bone; it may even be cured by the unassisted efforts of nature, without the occurrence of any exudation, by the formation of a fibro-nucleated membrane from the substance of the cartilage itself; or, it may be an accompaniment of disease of the synovial membrane or bone, ending in total destruction of the joint. It is very remarkable that in all these varieties, the structural changes in the cartilage are found, on microscopical examination, to be similar, consisting in changes in the structure and arrangement of the cells, and alterations in the hyaline substance.

When a thin slice of articular cartilage, in a healthy state, is examined with a microscope, it is seen to consist of an apparently homogeneous substance called the hyaline substance or matrix, with nucleated cells, named also cartilage corpuscles, disseminated through it with a certain order and arrangement. No blood-vessels are seen in cartilage, nor is there the slightest reason for believing that it contains any. Whatever nutrient fluid it requires, is derived from the vessels of adjoining textures, and is conveyed, it is believed, through the tissue by imbibition. No nerves have been traced in cartilage, and it is known to be destitute of sensibility. From this brief description of articular cartilage in its healthy state, the following account of its morbid changes will be more intelligible.

Fig. 142.

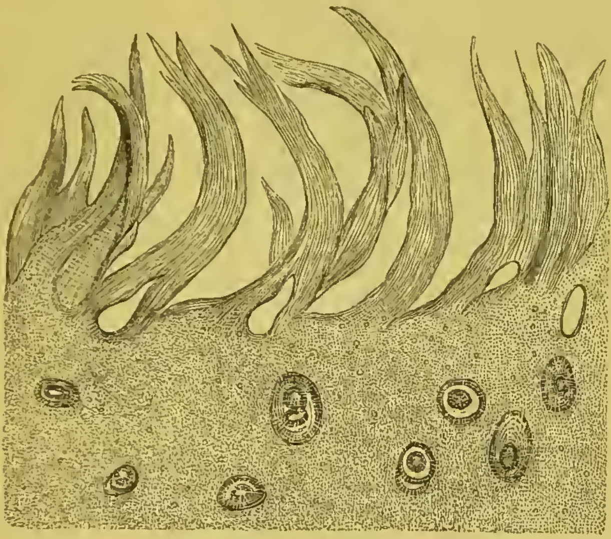


Diseased articular cartilage, showing enlargement of the corpuscles, and the contents of the more superficial thrown out into the intercorpuscular substance.—Redfern.

To Goodsir and Redfern belongs the merit of having successfully investigated the changes in the form, contents, and arrangement of the cells, and the alterations in the hyaline substance, which take place in the various forms of destruction of articular cartilage, and of having brought forward the views which are at present entertained regarding those changes. The principal structural changes observed in the cells and in the hyaline substance are the following.

As was first pointed out by Goodsir, destruction of cartilage is always accompanied by enlargement, change of form, and irregular arrangement of the cells. They become "larger, rounded or oviform, and instead of two or three nucleated cells in their interior, contain a mass of them." The enlarged corpuscles at the surface burst, and discharge their contents, so that the disintegrated surface presents a series of cavities. In many instances the contents of the cells, after having been discharged, assist the altered hyaline substance in the formation of a fibro-nucleated membrane on the surface of the diseased portion of the cartilage. This is called the yellow fibrous element, to distinguish it from the white, to be referred to in the description of the changes of the hyaline substance. In such cases the nuclei become elongated and incorporated with the fibres of the split-up hyaline substance; and this is one of the most remarkable transformations of the nuclei which have as yet been observed. Other changes of the nuclei, of frequent occurrence, are their conversion into fatty granules, and into fat globules. The conversion of the nuclei into drops of oil was first described by Rainy, and is beautifully delineated in the two accompanying diagrams by Redfern. This fatty degeneration of cartilage, considered a result of defect of nutrition, begins in the nuclei, which are transformed into granule masses, while the cell-wall may remain unchanged. Another change, which not unfrequently takes place in cartilage, is the infiltration of it with amorphous mineral matter, chiefly salts of lime, and in some instances at least these infiltrations are first seen in the cell-walls, of which an example, beautifully delineated by Redfern, is here introduced. In cases of very rapid destruction of cartilage, it appears that the changes are almost entirely confined to the cells.

Fig. 143.



Vertical section from the cartilage of the central part of the internal glenoid cavity of the tibia, showing the splitting into fibres on the surface.—Copied from Redfern.

The alterations in the hyaline substance consist of its losing its natural homogeneous appearance, and in its being split up into bands and fibres projecting into the joint and constituting the white fibrous element :—the white fibres being formed entirely out of hyaline or intercellular substance, and the yellow out of the nuclei of diseased cells. These bands become incorporated with the liberated and elongated nuclei, and thus constitute a fibro-nucleated membrane without the aid of any exudation, and by changes in the cartilage itself, without any other texture being involved. These fibres constitute processes projecting into the joint, separated from each other at their free extremities, and at their attached extremities, continuous with the hyaline substance. Redfern was the first to demonstrate the conversion of the hyaline substance into fibres in disease of articular cartilage. Sometimes the cartilages are thinned and capable of being easily torn from the bones, and, in still more aggravated cases, portions of them, no doubt the subject of death in continuous mass,

Fig. 144.

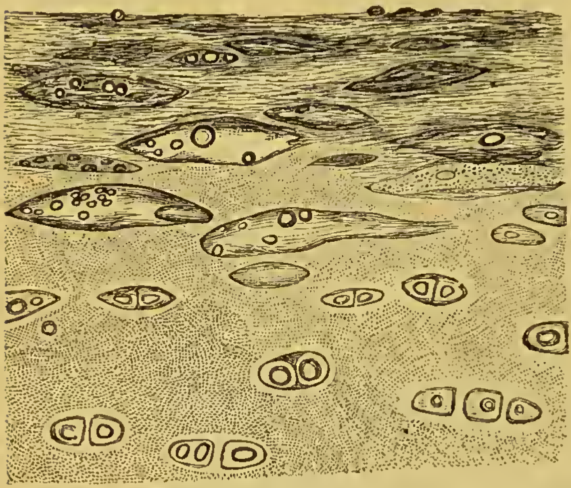


Fig. 145.

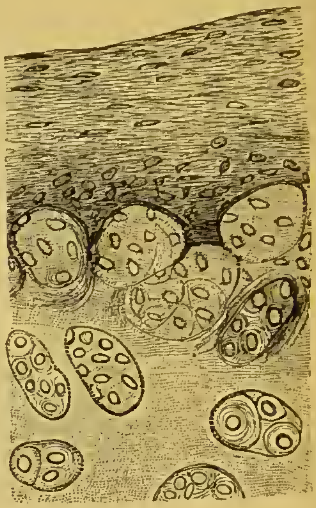
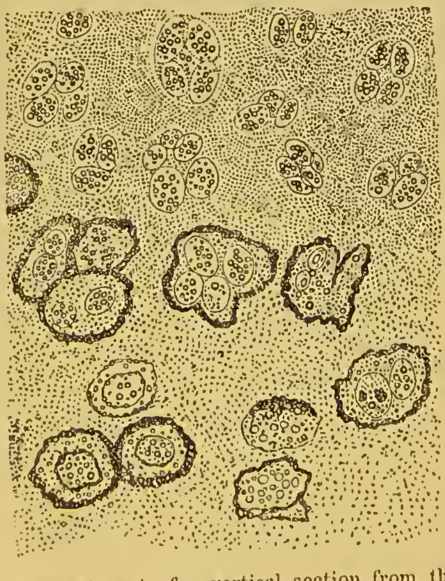


Fig. 144.—Vertical section of loose cartilage on the posterior surface of the third cuneiform bone, showing the superficial cells enlarged, and containing fat globules and granules.

Fig. 145.—Vertical section of the cartilage on the anterior surface of the cuboid bone, showing the enlargement and bursting of the deep cells, and the fibro-nucleated membrane, with its nipple-like processes on the surface.—Redfern.

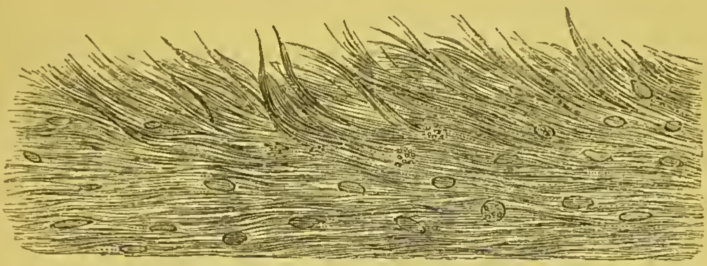
Fig. 146.



Deepest part of a vertical section from the cuneiform surface of semilunar, showing the cells with thickened walls. —Redfern.

are actually detached and in a manner loose in the joint. These conditions are always found associated with disease in the subjacent bone—the disease of the bone no doubt taking the initiative, and the destruction of the cartilage, instead of affecting the whole thickness, spreads horizontally along the surface directed to the bone. In some instances, the articular lamina of the bone has been found entirely destroyed, and the cartilage, in consequence, more or less completely undermined. Cartilage during the whole of its processes remains non-vascular, and the membrane above referred to is regarded as the result, not the cause of the destruction. Matter never forms until other textures become involved; and the distressing symptoms which at one time were believed to depend on destruction of cartilage, now are supposed to denote morbid changes in the bone. If other textures become involved, exudation may take place from them, and the exuding matter, becoming pervaded by vessels derived from the involved texture, constitutes a vascular adventitious membrane in contact with the diseased portion of cartilage. This membrane is sometimes formed between the bone and the cartilage; and there can be no doubt that to its formation in that position and its becoming pervaded by vessels derived from the bone, may be attributed the erroneous impression entertained by some observers, that in one form of destruction of articular cartilage, the destruction is preceded by the formation of vessels in the substance of the cartilage itself. The usual situation of the adventitious membrane is on the free surface; and its formation is properly attributed to the circumstance of the synovial membrane becoming involved and giving out an exudation which becomes pervaded by vessels derived from itself. It is quite certain, that in many cases, there has been found extensive ulceration of cartilages without the presence of any vascular membrane; and it is equally certain, that in others, cartilage has been found covered by a newly-formed vascular membrane without being ulcerated.

Fig. 147.



Cartilage of the patella, showing, on the surface, fibrous tissue with included cells and nuclei.—Copied from Redfern.

Dr. Redfern, in his work on abnormal nutrition in articular cartilage, has given the following as the conclusions at which he has arrived in consequence of his investigations:—

1. That all the known forms of disease in articular cartilages are

connected with changes in the texture, which are essentially similar to each other.

2. That during the progress of these changes, the cells of the cartilage become enlarged, rounded, and filled with corpuscles in lieu of healthy cells; bursting, subsequently, and discharging their contents into the texture on the surface; whilst the hyaline substance splits into bands and fibres, and the changed hyaline substance, and the discharged corpuscles of the cells, afterwards form, in many cases, a fibro-nucleated membrane on the surface of the diseased cartilage.

3. That these changes are referable only to an abnormal nutrition as their immediate cause, and in no case to mechanical or chemical actions, such as attrition or digestion in a diseased secretion.

4. That most extensive disease may go on in many joints at the same time, and may proceed to destroy the whole thickness of the cartilage in particular parts, without the patient's knowledge, and whilst he is engaged in active occupation.

5. That the disease commences most frequently on the free surface; but may proceed from the bone to affect the attached surface, or may take place in the middle of the thickness of the cartilage.

6. That it is, at least, very doubtful if the symptoms which are believed to indicate the existence of ulceration of articular cartilages, are not really dependent on a morbid change in the bone.

7. That disease of the whole thickness of an articular cartilage at particular parts admits of a natural cure, by the formation of a fibro-nucleated membrane from the substance of the cartilage, without the occurrence of any new exudation.

Favourable Results.—These vary according to the depth of the destruction. If only a portion of the cartilage be removed, the destruction not extending through the whole of its depth, the diseased part may be healed, on the subsidence of the abnormal nutrition, by a fibro-nucleated membrane, formed entirely from the cartilage itself in the manner already described. In such cases, the affected part, as will be understood from what has already been stated, presents a villous appearance.

If the destruction be superficial, and the synovial membrane be involved, there may be incorporated with the fibro-nucleated membrane a depressed cicatrix formed by exudation from the synovial membrane.

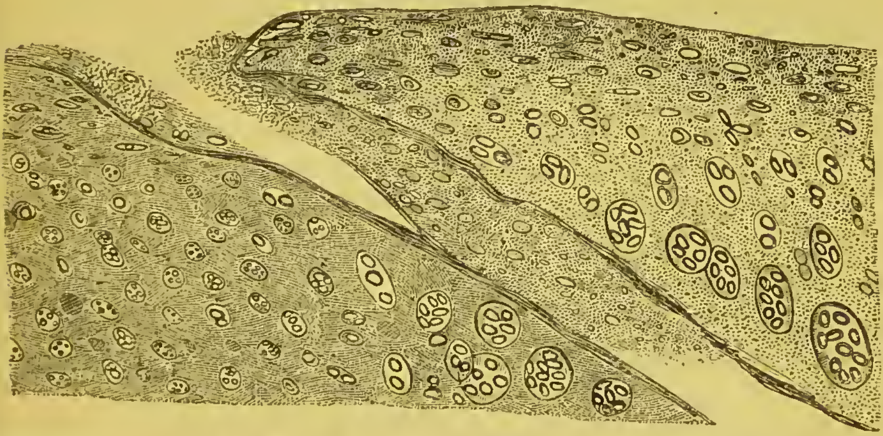
When the loss of substance is to a greater depth, exposing the surface of the bone, or when a limited portion of the bone is removed, exudation may take place from the vessels of the bone, and osseous granules, not rising to the level of the cartilage, may occupy the affected part, or the granules may be covered by a depressed cicatrix derived from the synovial membrane.

Reproduction of cartilage never takes place, and instead of any of the above favourable results, the place of disintegrated cartilage may be occupied by an amorphous formation, technically called the porcellaneous deposit. This substance fills up the cavity, and its smooth and polished surface compensates for the want of cartilage and of synovial membrane.

If there happen to be destruction of cartilage and osseous granulations on opposite sides of an articulation, the granulations may unite, and a form of anchylosis be produced.

After making numerous examinations of human articular cartilages in a state of disease, Redfern made an extensive series of experiments on the lower animals, which resulted in demonstrating, that injuries inflicted on cartilages give rise to changes in the cells and in the hyaline membranes, precisely similar to those observed in cartilages of the human body; that repair may be effected by fibrous tissue, containing both the white and the yellow fibrous element, or by calcification of the portion left after the injury. These experiments have also demonstrated most clearly that wounds of cartilages are capable of perfect union by the formation of fibrous tissue out of the cut surfaces.

Fig. 148.



Section of the cartilage of the patella of a dog passing through an incision made forty-nine days before death.—Redfern.

The essential part of this process is believed to be the softening of the intercellular substance, the formation of white fibres from softened intercellular substance, and of nuclear fibres by the elongation of free nuclei. By the kindness of Dr. Redfern I am allowed the use of his beautiful diagrams, which demonstrate so clearly the results of his experiments.

It is not believed by him to be necessary that the cells should be much enlarged or crowded with corpuscles; for, although it took place in the union represented in one of these figures, in that represented in the other two, where it was more perfect, there was no enlargement of the cells, or crowding of them with corpuscles.

An exceedingly interesting paper has been published by Redfern on the "Healing of Wounds in Articular Cartilage, with Remarks on the Relation between Diseases of Cartilage and Ulceration and Inflammation in other Textures," and the conclusions at which he arrived are expressed in the following terms:—

"I think that the demonstration has been fully made, that every morbid action which takes place in the structure of cartilage is referable to an abnormal nutrition of its texture, and, in so far, all these morbid actions resemble inflammation: they differ from it, 1st, in not being attended with exudation, because the texture in which they occur contains no blood-vessels; and, 2nd, in not giving rise to pain on account of the absence of nerves. If, therefore, inflammation be *merely* a process of abnormal nutrition, it takes place in cartilaginous as well as in other textures; but, if we include exudation as an essential phenomenon of inflammation, it never affects the human articular cartilages, which contain no blood-vessels, and present no exudation in disease. So with ulceration,—if we are to separate the softening, degeneration, and ejection of tissue, in the formation of an ulcer from the exudation, which is an almost constant attendant on this process in vascular tissues, and forms cicatrices in them, then ulceration in cartilage and in other tissues is identical, though the method by which ulcers heal, in the two forms of texture, is altogether different; if, on the other hand, we include in the term ulceration the production of exudation, and its transformation into the tissue of the cicatrix, then it is equally clear that ulceration in cartilage and in vascular tissues differs in the occurrence of those phenomona in the latter case, and not in the former."

Fig. 149.

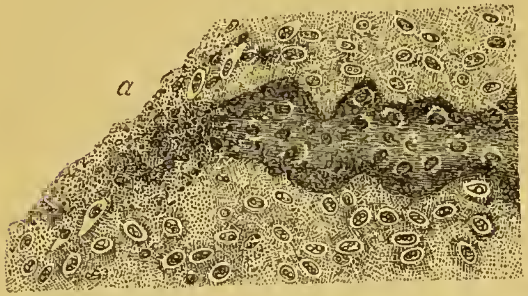


Fig. 150.

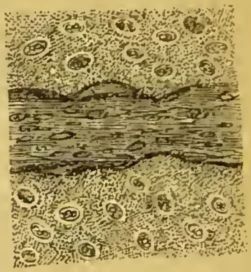


Fig. 149.—Vertical section of the cartilage of the patella of a dog passing through an oblique incision made twenty-four weeks and five days before examination, and showing perfect and firm union of the cut surfaces.

Fig. 150.—Section of the cartilage of the femur of a dog passing through an oblique incision made twenty-four weeks and five days before examination, and showing the perfect fibrous tissue developed in the healing of the wound.—Redfern.

Finally, I would call attention to the following conclusions:—

1st. Wounds in articular cartilages heal perfectly, by the formation of fibrous tissues out of the cut surface.

2nd. The fibrous cicatrix consists of white and yellow fibres, which are formed out of the intercellular tissue substance of the cartilage, and out of the nuclei of its cells respectively.

3rd. Articular cartilages disappear after amputation at the joints, either by being transformed into fibrous tissue, which is mixed with that of the cicatrix, or by slow injection of their particles into a newly completed synovial sac.

4th. Ulceration in articular cartilages differs from that in other tissues, in being neither accompanied by exudation, nor attended with pain,—differences which depend on the absence of vessels and nerves.

5th. Ulcers in articular cartilages heal by transformation of the surrounding cartilage tissue into fibre, but those occurring in other textures are cured by the formation of a cicatrix out of newly exuded blood plasma.

6th. Inflammation, regarded as a process of abnormal nutrition, attended with changes in the blood and blood-vessels, including exudation as an essential phenomenon, does not occur in articular cartilages in man, simply because these textures contain no blood-vessels.

7th. The whole diseased states of cartilage are referable to a changed or abnormal nutrition of the texture, and to this alone; when unaccompanied by disease in other textures, they produce no pain or other symptoms by which they can be recognised, and have much less surgical importance than they have for many years been supposed to possess.

SCROFULOUS DISEASE OF THE JOINTS IN WHICH THE CANCELLATED STRUCTURE OF THE BONES IS PRIMARILY AFFECTED.

Morbid Changes.—The morbid changes in the early stage are those mentioned in the description of scrofulous tubercular abscess of bone. The morbid changes in the bone may lead to destruction of the cartilages and discharge of the collection in the bone into the joint.

The ulceration of the cartilage and synovial membrane, and the discharge of the deposit originally contained in the bone, are followed by general synovitis, which very rapidly terminates in suppuration; and the contents of the joint, consisting of purulent matter, tubercular degeneration, and the debris of the bone, may ultimately be discharged by ulceration of the external soft tissues. Soon after the disease is fully established, and the communication is opened as above described between the diseased cavity and the joint, the changes within the bone are followed by effusion of lymph into the soft parts immediately surrounding the bone, which gives rise to a firm swelling, by gelatinous infiltration of the synovial membrane and surrounding textures; and at a more advanced period, by effusion of serum into the cellular tissue, which causes slight œdema. There is, at an early stage, a hard swelling from effusion of lymph, and afterwards a swelling with fluctuation from the distension of the synovial membrane by the contents of the cavity of the joint. The skin over the swelling remains white, but from its natural wrinkles being unfolded, it presents a kind of glazed appearance; the veins under it become large, and the parts above and below the joint, weak, soft, and emaciated. The condition of parts in many cases revealed by dissection may be stated to be scrofulous abscess and caries of bone, communicating with the cavity of the joint in consequence of more or less extensive destruction of cartilage; an inflamed condition of the synovial membrane, abscess of the joint, gelatinous infiltration of the synovial membrane and of surrounding textures, and more or less extensive riddling of the parts above the joint by abscesses and sinuses. The tubercular deposit is regarded as a transformation of liquor sanguinis exuded into the part in consequence of some grade of the inflammatory process; but this grade is very slight compared to that which takes place when the disease extends into the synovial membrane of the joint.

Symptoms.—Slight pain, or uneasiness scarcely amounting to pain, and felt only at times, and a considerable sense of weakness of the articulation, are usually the earliest symptoms. As the morbid changes advance, the pain becomes more severe, and is for a long time referred by the patient to a particular spot about the extremity of the bone. The pain is of a heavy, aching, bursting character, and is generally brought on by the heat of bed, by the dependent posture, and by motion. These symptoms are coeval with the changes in the bone. In the course of time, the pain is followed by a swelling, which at first is firm, hard, and unyielding, and seems to depend on enlargement of the bone.

It was at one time a common opinion, that the heads of the bones were always expanded in this disease. Russel, Crowther, Lawrence, S. Cooper, and others, expressed an opposite sentiment, and the belief became general that the swelling which appears like expansion of the bone is owing to plastic and gelatinous deposits external to the bone; but more recent observers have met with examples, and I have seen a good many specimens, which prove incontestably the existence of expansion of the bone.

That the head of a bone is occasionally enlarged in other diseases, it is impossible to deny; but the cases I refer to were examples of expansion of the shell combined with tubercular deposit in the bone, and no doubt the inflammatory process that coexisted with the deposit led to the expansion.

In the next stage, the pain is throbbing, and extends over the whole articulation; and the swelling is no longer confined to the situation of the bone, but is general over the whole joint, and presents the character of fluctuation. These symptoms are coeval with the inflammation of the synovial membrane. Ultimately the skin becomes tense, white, and glistening, and is marked with dilated tortuous veins; and the inflammation extending to the superimposed soft tissues, often gives an œdematous character to the swelling. The disease has already advanced to suppuration, and the matter, together with the debris of the bone, may be discharged through ulcerated apertures. At first, there is little constitutional disturbance. After some time, inflammatory fever comes on, and is ultimately succeeded by hectic. This, like other varieties of scrofulous disease, is chiefly incidental to young persons, and usually occurs before the age of puberty; and although it has occasionally been found in persons in the middle period of life, yet it rarely attacks any one after thirty years of age, who has not previously been the subject of scrofulous disease.

Treatment.—In this, as in all scrofulous diseases, the local affection is very much influenced by the state of the general health, the improvement and maintenance of which becomes therefore of paramount importance. The formation of tubercular deposit in the cancellated structure of the bone takes place at an early period, and the conditions most favourable to its formation are the scrofulous diathesis, and a weak state of the general health. It is often found in persons of that habit, who have been confined to situations where the air is impure, cold, or damp; who have been excluded from free exposure to the light of the sun; who have lived on a diet not sufficiently nutritious; who have not enjoyed regular exercise and fresh air; or who have been subjected to any cause of debility. If the presence of the deposit be suspected, the endeavour must be made to limit its extent, and to delay the suppuration by removing the patient from the exciting causes of the unhealthy secretion. For that purpose, the best constitutional treatment is that which is mentioned when treating of scrofulous chronic synovitis, which need not again be described. The means there recommended for improving the general health will be found most effectual for limiting the tubercular deposit, and preventing and repressing inflammation; for in this, as in all scrofulous diseases, more benefit may be expected from constitutional than from local treatment.

For facilitating the description of the local treatment, the disease may be considered in three different stages:—

1. When it is confined to the bone; 2. When it extends into the articulation; 3. When the abscess bursts, or is opened.

In *all* these stages, rest is an important part of the treatment.

In the first stage, the indications to be fulfilled are—to limit the disease, and prevent its extending into the joint. With this view, in addition to rest of the limb, cold applications are sometimes employed with advantage. Local depletion and counter-irritation are at times necessary, but the employment of depletion forms no prominent part of the treatment. In this stage I have frequently prescribed leeches, when, from any circumstance, there seemed to be a fresh accession of inflammation, and the apparent result has been to relieve, for the time, the urgency of the symptoms; but beyond this, I have never been sensible of any advantage, and in no case have I ventured on the practice but with reluctance. It ought always to be remembered, that depletion has less influence in scrofulous than in common inflammation; and that if carried so far as to produce an impression on the general health, it increases the danger of the local affection. Mild counter-irritation, to an extent not to affect the general health, may, in general, be resorted to with advantage.

The paramount indication, however, is perfect immunity of the joint from motion, and unless that indication be fulfilled, treatment will be of no avail. Gutta-percha or leather splints lined with flannel, and starch bandages, are the best appliances for that purpose. I prefer splints of gutta-percha to those of leather; but in the event of local applications not being necessary, the starch bandage, applied so as not to cause any undue pressure, is exceedingly convenient, and even where issues are necessary, it will often be found the best means of keeping the joint at rest; and openings, or, as they have been called, traps, may be cut out to allow of the application of issues or other means for counter-irritation. If splints or the starch bandage be nicely applied, the patient may be drawn out into the open air, which is so important in this disease.

In the second stage, rest, with warm emollient applications, as poultices and fomentations, are the local remedies most likely to give relief.

In the third stage, rest is necessary, lest any of nature's attempts at anchylosis should be frustrated. If abscess forms, it should be freely opened by a sufficiently long incision, a poultice applied, the limb preserved in a serviceable position, and the constitutional symptoms carefully attended to. Pressure should also be employed so far as to diminish the size of the sinuses, without obstructing the discharge of the purulent matter. If the disease continues to advance, and the hectic fever be to such an extent as to endanger life, excision of the joint or amputation may be necessary; but before determining on these steps, the state of the internal organs should be carefully examined, with the view more especially of ascertaining whether or not the patient be free from pulmonic and mesenteric disease; for it may be found that the tubercular degeneration is general, and, if so, there is but little probability that an operation would be followed by recovery.

MORBUS COXARIUS, OR SCROFULOUS DISEASE OF THE HIP JOINT.

This disease, most commonly affecting children and individuals under the age of puberty, is occasionally though more rarely met with at a later period. It forms the great majority of cases of hip-joint disease in children and in persons under puberty, and begins in the cancellated structure of the acetabulum, the femur, or of both; whereas the disease of the hip-joint usually met with after puberty, and most common between that period and the thirty-fifth year, is believed to commence in the other texture of the joint. Out of 102 cases of hip-joint disease of which I have the age of the patients, 80 were under 16 years of age, 19 between 16 and 35, and 3 between 35 and 40. As the morbid changes are of the same nature as those of scrofulous disease of joints in which the bone is primarily affected—this being an example of that form of disease in the hip,—it will not be necessary to give so lengthened a description of certain points, as would otherwise have been requisite.

Symptoms.—These have been divided by some authors into two stages or periods, by Ford and others into three, and some have arranged them into four stages or periods, the first being what they call the period of invasion. In the following description we shall divide them into three stages.

First Stage.—This, like some other scrofulous diseases, is of so insidious a nature, that it has often made considerable progress before its existence is suspected, the patient complaining for a long time merely of weakness and weariness of the limb, with uneasiness at the knee, but without any pain at the hip. This absence of pain in the affected joint has, in some instances, led unwary practitioners to mistake the seat of the disease. With these symptoms, there is a halt or slight limp in walking, and if the extremity be examined at this period, it will be found that the hip is flattened by the wasting of the glutei muscles, the limb emaciated, and the affected extremity elongated; which last phenomena arises, as is explained by Hunter, from the pelvis being lower on the diseased side, in consequence of the patient supporting the body on the sound limb. As the disease advances, there is usually decided pain in the hip-joint;—in some instances, however, it is inconsiderable when compared with the pain at the knee. The pain is increased by motion, or by pressure of the trochanter inwards, or of the limb upwards, or by any means which direct the pressure against the diseased portion of the joint; and sometimes the patient, to relieve the parts affected as much as possible from the pressure, maintains the limb in a position, in which the ball of the femur is made to press least against the acetabulum. The pain is felt in the joint, and also at the knee, principally along its inner side; and though the knee is only sympathetically affected, the pain is sometimes more severe there than at the hip, so that it is occasionally difficult to convince a patient that the seat of the disease is not in the knee. This is an exemplification of what is frequently observed, namely, that when disease exists at one set of terminal expansions of a particular nerve, the pain is often referred to the extremities of other branches given off by the same nerve; for the anterior crural nerve gives branches to the hip and also to the knee; and the trunk of the obturator nerve supplies the hip-joint with nerves, while its anterior and posterior branches give nerves to the knee.

Before the termination of this stage, there is a sense of tension in the groin, and the lymphatic glands in that situation usually begin to swell.

Second Stage.—The pain at the knee is much increased, and is almost always considerably greater than at the hip, but in the last-mentioned situation only is it increased on pressure, which is an excellent guide to the seat of the disease. There is pain at the hip-joint on concussion produced by striking the trochanter, the knee, or the sole of the foot. The pain is much aggravated by motion; the patient supports his body entirely on the sound limb; the motions of the joint are impeded, so that flexion and extension cannot be carried to their natural extent, and there is also limitation of rotation, especially of rotation inwards, any attempt at which gives rise to great pain. Forcible abduction also causes pain at the hip. There is considerable swelling about the upper part of the thigh, together with the other symptoms, namely, flattening of the hip and its consequent unnaturally broad appearance; a lower position of the trochanter and fold of the hip, than on the sound side; wasting of the limb, and apparent elongation of the extremity. Some surgeons state, that real elongation takes place in this stage; but for my own part, though I have given particular attention to this point, I have in every instance found the elongation seeming, and not real. By those who believe the elongation to be real, various explanations have been offered. Some suppose that, from the relaxation of the muscles and ligaments, the thigh-bone is partially expelled from its socket, and so falls down; others, that the under part of the acetabulum being destroyed, it thus becomes wider, and the muscles relaxed; while there are those who think that the under part of the acetabulum and part of the head of the femur are simultaneously destroyed. I believe, however, that, in every instance, the lengthening will be found to be only apparent, and that if the patient be placed in a horizontal position, and a careful examination be made of the measurements between corresponding points of the pelvis and extremities, they will be precisely the same on both sides of the body. With alteration of the position of the pelvis, there is often found lateral curvature of the spine.

Third Stage.—In this stage the swelling is larger and more painful, it presents the character of fluctuation, and ultimately breaks, the matter which continues to be discharged being of an unhealthy character, and indicating carious destruction. Sometimes the abscess, instead of appearing on the thigh, has made its way into the pelvis through an opening occasioned by the destruction of the bottom of the acetabulum; in some cases it has burst into the vagina, and in others into the rectum; and occasionally it has been found to be discharged into the pelvis, and thence to escape through the ischiatic notch. The appearance of an abscess is always an extremely unfavourable symptom. In this stage, the extremity becomes really shortened, either from destruction of the margin of the acetabulum, whereby the cavity becomes shallower and wider, so as to admit of the limb being drawn up, or from this condition combined with destruction of the head of the femur, or from actual dislocation. The shortening is sometimes sudden, but more frequently gradual. When dislocation takes place, —which, however, is not always the case,—the head of the femur is usually, although not invariably, drawn upwards and outwards upon the dorsum of the ilium. In this case the trochanter major is drawn upwards near the crest of the ilium, and the hip is protuberant, the swelling being produced by the upper extremity of the femur, and the muscles which are raised up by it. The wasted condition of the limb makes the swelling appear greater than it really is.

Such, in general, are the symptoms of this disease: but surgeons have been exceedingly anxious to ascertain, how the symptoms are modified according as the disease commences in the bones, as in hip-joint disease of young persons, or in the softer textures, as in that of adults; and also when the bones take the initiative, whether there be any modifications of the symptoms according as the disease is chiefly in the acetabulum, or chiefly in the femur. When it begins in the acetabulum, a most fatal variety of the disease, the pain at first is seldom in the hip or in the knee, but in the iliac fossa and side of the pelvis; it becomes, however, at last severe in the joint, and greatly increased by the ball of the femur being sent in against the acetabulum, and tho patient cannot, in consequence, support his weight on the limb. The abscess usually becomes intra-pelvic, and may point in the iliac fossa, or at the lower part of the pelvis, or into the pelvic viscera.

I lately saw two cases, in each of which the abscess made its way into the rectum, one where it opened into the vagina, and another where it opened into the bladder. Dislocation is not so common in the acetabular variety as in the femoral; but in some instances the head of the bone has been found projecting into the pelvis through the bottom of the acetabulum. When the disease commences in the femur, constituting what some have called the femoral variety, to distinguish it from the acetabular, the symptoms are usually of a very insidious character, the pain at the knee is more marked in this than in any other variety, dislocation is very apt to occur in the advanced stage, the limb is in general bent, and in both these varieties abscess, sooner or later, takes place. A peculiarity of symptoms not unfrequently observed in this form of the disease is, that at first the limb is everted by the irritation of the powerful rotators outwards, whereas in the advanced stage, owing to these muscles being weakened by abscesses forming under them, and by becoming the subject of fatty degeneration, the psoas, iliacus, and adductor muscles being no longer overbalanced, flex, adduct, and turn the limb inwards. When both bones are affected, the symptoms will more or less partake of the peculiarities of the acetabular and femoral varieties, and in the hip-joint disease of adults, named by some the arthritic form, has the ordinary constitutional and local symptoms of arthritis, which need not here be enumerated. By these symptoms, the age, and the extreme urgency of the local symptoms at the commencement, the diagnosis is easily made out.

The general health is at first but little affected in the disease of early life; after some time, slight symptoms of inflammatory fever may supervene; but the formation of abscess is followed by hectic, and its usual train of consequences.

Morbid Changes.—Opportunities of making dissections in the third stage are unfortunately numerous; but as in that stage the whole articular apparatus is involved, it is impossible then to discover by dissection which structure was primarily affected. Opportunities of examining the state of the parts in the early stages are not numerous, being only met with in those persons who have died of other diseases after the hip-joint had become affected. From ex-

Fig. 151.

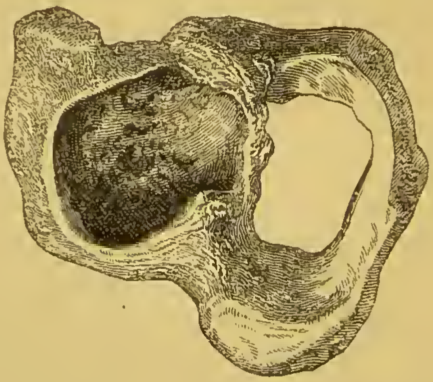


Fig. 152.

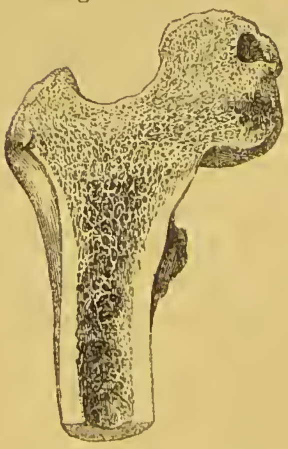
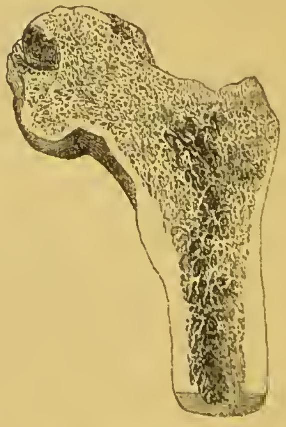


Fig. 153.



Early stage of Morbus Coxarius, exhibiting tubercular deposit in the substance of the bone forming the acetabulum, and in the head of the femur. On the articular surfaces of both bones various irregularities and hollows are observed leading to masses of the deposit. The patient died of inflammation of the brain, which afforded an opportunity of verifying the diagnosis made during life. From preparations in my museum.

aminations, however, which have been made in such circumstances, there is reason to conclude that this disease begins in the bone—that the morbid changes are of the nature described in the section on scrofulous disease of joints beginning in the cancellated structure—that in the majority of cases the os innominatum is primarily and most extensively affected—that it sometimes begins in the femur, and that occasionally the morbid action commences contemporaneously in both bones, of which the case from which the accompanying illustrations were taken, furnished a good example. The first deviation from the healthy condition is, according to Brodie, that part of the cancellated structure becomes preternaturally vascular—that at an early period the affected part becomes unusually soft from a deficient proportion of earthy matter, and that a thin fluid is deposited in the cancelli. These changes constitute the anatomical characters at an early period of the disease. As the disease advances, the bone becomes still softer, and, instead of a thin fluid, tubercular substance is deposited in the cancelli, and, in many instances all traces of cancellous structure disappears, its place being occupied by the tubercular substance, as several beautiful specimens in my own collection demonstrate. According to the views now entertained, the scrofulous deposit is a transformation of liquor sanguinis exuded in consequence of a slight grade of the inflammatory process. In the progress of the disease, the structures between the deposit and the joint undoubtedly become involved in a process of inflammation; and as a result of this, a communication is established with the cavity of the articulation, and the whole articular surface becomes the subject of the morbid changes described in the section of scrofulous diseases of the joints beginning in the cancellous structure, which changes it is unnecessary here to repeat. That an inflammatory process occurs in the progress of the disease, all agree; but as to the nature of the morbid action of which the tubercular deposit is a result, there has been a difference of opinion. Sir Benjamin Brodie, Lloyd, Rust, and others, regard the deposit as a product of inflammation, while others think it may be a result of perverted nutrition or secretion unconnected with inflammation.

For an account of the views at present entertained regarding the tubercular diathesis, the causes, nature, degenerations, and treatment of tubercular exudation, the reader is referred to the chapter on Tubercle.

Treatment.—After what has been already stated regarding the treatment of disease of joints beginning in the cancellated structure, it seems unnecessary to give any lengthened remarks on the treatment of morbus coxarius. As the maintenance of the general health is a paramount indication, every judicious and available means for that object, consistent with the fulfilment of other necessary indications, must be adopted, their use being modified according to the particular circumstances of the case. The feeble state of the patient's constitution will scarcely admit of antiphlogistic treatment; but antiphlogistic regimen may be necessary until the inflammatory symptoms have been subdued. "Local abstraction of blood," Mr. Liston remarks, "is seldom at all required, and its employment in cases of morbus coxarius in weak constitutions, which it generally seizes upon, is very questionable." The most important parts of the local treatment are, the strict observance of rest, and the employment of counter-irritation. Without perfect rest of the joint no treatment will be of any service for checking the symptoms in the early stages, or promoting anchylosis in the advanced stage. It will in general be found impossible to obtain that necessary rest without rendering the pelvis, thigh, and leg immovable on each other. This I have done to some patients who could afford to procure them by some of the well-contrived splints now in use, but I have found no appliance more convenient than the starch bandage. Nothing could answer better than the application of starch bandage from the toes to the pelvis, care being taken to protect the knee by padding it with cotton, and having the bandage carried in the form of a spica round the shafts and pelvis. It forms an extremely nice encasement, which should be rendered more resisting behind by a long nicely moulded and lined pasteboard or gutta-percha splint, extending from the pelvis to the middle or lower part of the leg. Issues can be applied by cutting out openings in the bandage. For producing counter-irritation, blisters, setons, issues, moxa, the potential and the actual cautery, have all been used. We find that in the time of Hippocrates, counter-irritation by the actual cautery was employed in this disease, and in modern times some consider it preferable to other means. For my own part, I have followed the method recommended by Sir B. Brodie, namely, the employment of blisters in children and issues in adults, which he makes by the application of the potassa-fusa, and keeps open by repeatedly touching the issue with caustic.

The best situations for issues are the hollow between the trochanter major and the tuberosity of the ischium, and the outside of the joint near the situation of the tensor vaginæ femoris. Issues ought never to be employed to such an extent as to be a cause of debility, and they should be at once discontinued on the appearance of undoubted signs of the existence of abscess. In recent cases, blisters usually give considerable relief. With regard to the treatment of abscess in this disease, much difference of opinion has prevailed; but as no good can result from delay, and as time may be saved, and suffering and more extensive destruction of tissue prevented, the sooner a free, direct, and dependent opening is resorted to the better, suitable treatment at the same time being instituted, to prevent, if possible, the occurrence of hectic. When the disease has attained a certain progress, the only possible favourable result is anchylosis, and an important point to be constantly kept in view is, while all available means are being employed for promoting that desired result, that the limb be kept in a serviceable attitude,—that is, perfectly straight. I have had the satisfaction of seeing this result in a considerable number of cases, and it is surprising with how little inconvenience patients come to walk with perfect anchylosis of the hip, owing to the increased mobility acquired at the lumbo-sacral articulation, and by the lumbar vertebræ allowing the pelvis to rotate on the spine in walking.

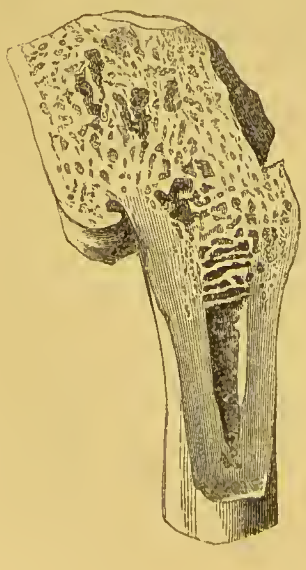
Operation.—Time and the best-directed constitutional and local treatment having been tried and failed, the surgeon, in certain cases, is justified to attempt to save his patient from being brought to the tomb by hectic fever by an operation; the object aimed at being the removal of diseased bone. The most promising cases for operation are those in which the disease is confined to the femur, and the bone dislocated upon the dorsum of the ilium; those which are less encouraging, but in which success has sometimes followed removal, are, where femur and margin of acetabulum have both been found diseased and been removed; and those in which it is altogether unjustifiable—and unfortunately such cases are numerous—are cases in which the disease is chiefly in the acetabulum, or in which it is extensively affected as well as the femur; and if the head of the bone be still on the acetabulum, they are, if possible, still more unsuitable for operation. The operation may be performed in the following manner:—The body being turned a little towards the other side, to raise up the hip, one incision should be made in a semi-lunar direction, about two inches or more above the trochanter, and limited so as not to cut the gluteal artery behind, or the anterior crural nerve in front, and from the centre of the concavity of this incision a straight incision should be made downwards over the trochanter, these incisions in point of length being proportioned to the size and depth of the parts. The flaps should then be turned backwards and forwards, and on laying bare the trochanter major and capsular ligament, the capsular ligament should be opened above and behind, and on placing the thigh across the opposite one, and pressing upwards, the sound ligament, if still entire, will likely give way, but if not, it may be easily divided, when the articular surface of the femur will be fully exposed. The saw should then be applied, and the ball removed. If the head of the bone be lying on the dorsum of the ilium, the operation will be still more easily performed. The margins of the acetabulum have also been removed, and Jones of Jersey, and Hancock of London, have both been successful in cases where large portions of acetabulum were removed. The after treatment consists of rest, support, water dressings, the straight position of the limb, and extension by means of a long splint with a bracket for the thigh, so as to admit of that portion being taken off during the dressing without disturbance of the rest of the splint. Fergusson particularly recommends that extension should be made from the opposite thigh, round the upper part of which a laced socket is applied. This operation was first proposed by Mr. Charles White of Manchester; it was first performed, forty years after the first proposal, by Mr. Anthony White of London; and twenty-seven years afterwards it was again performed by Professor Fergusson; and since, it has been repeatedly done by him, and recommended by him in the strongest terms to the favourable consideration of surgeons.

Besides White, Fergusson, Jones, and Hancock, already mentioned, Simon Smith, French Walton, Cotton of Lynn, Morris of Spalding, Buchannan of Glasgow, Sayre of New York, Kinloch of Charleston, South Carolina, Hewson, and Texton, are some of the many surgeons who have performed this operation with the view of saving life in morbus coxarius. I have been extremely anxious to obtain accurate statistics of this operation, but have failed to procure them from some parts of the world where it has been several times performed. So far as I have been able to learn, the operation has been performed in 70 cases, and death has resulted from the operation in 25. Sayre of New York gives an analysis of 30 cases; of which 20 recovered, and 10 died, 4 of them within one week after the operation.

ANCHYLOSIS.

Anchylosis is an expression used to imply stiffness of a joint, without reference to the limb being straight or bent, though its etymology has reference to angular deformity, which so often characterizes this affection—the word being derived from ἀγκύλος, signifying crooked.

Fig. 154.



Classifications.—There are several forms of anchylosis, and various divisions have been made, based upon different conditions of the joint. A classification, having reference to the degree of the affection, is into complete and incomplete, and one intended to denote whether the seat of the disease is in the joint or in the neighbouring tissues, is into true or intra-capsular, and false or extra-capsular. For making more clear the etiology and the therapeutic indications, we shall adopt the classification made by some into four varieties.

Of many fine specimens of anchylosis in my collection, the first of the accompanying drawings represents one of a section of the hip-joint, in which the anchylosis is very perfect, after the whole of the cartilages have been removed; the cancellated structure of the one bone is perfectly continuous with that of the other. The second drawing gives a representation of another very perfect specimen of anchylosis, also in my possession. The third represents a specimen now in my collection, given to me by my late friend, Mr. Liston, and represented in his "Elements of Surgery."

Fig. 155.

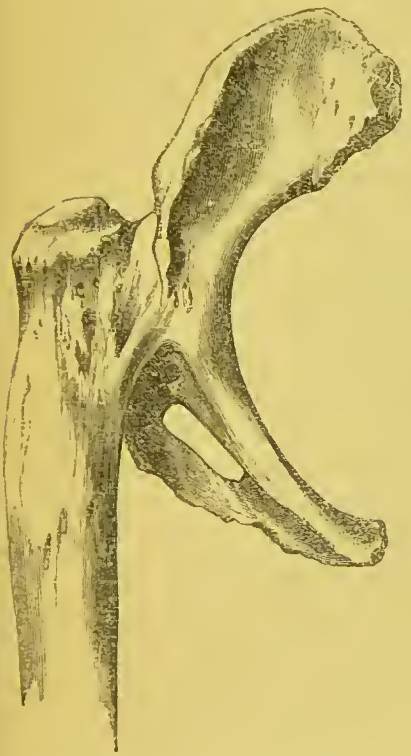
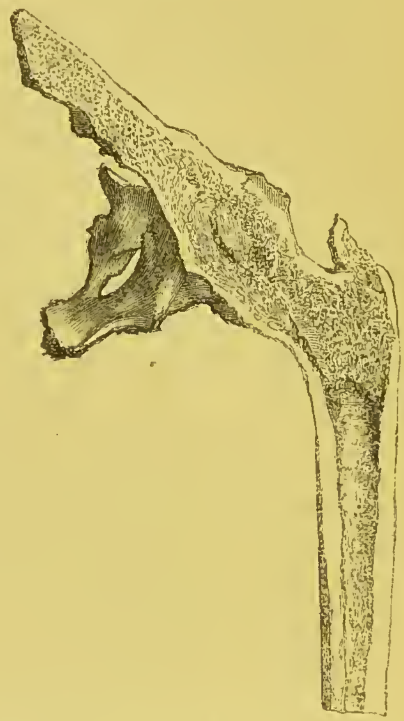


Fig. 156.



1. *Osseous, or true.*—This may be general and complete at every part; all traces of articulation being effaced. Or the osseous union may be in the interior of the joint, but the incorporation of the opposing bones may be only at certain parts. Or the joint may be perfectly locked, in consequence of exuberant granulations on the exterior aspect; the parts being rendered immovable chiefly by outer incasement of bone.

2. *Fibrous.*—After removal of the cartilages, the opposed surfaces may be united by fibrous tissue.

3. *Ligamentous.*—The ligaments not unfrequently become rigid and non-elastic to an extent to make a joint more or less immovable, while the articular surfaces remain unincorporated.

4. *Spurious.*—This term has been used by some to denote that form of anchylosis in which the stiffness depends on fibrous depositions in textures external to the joint gluing the various structures to each other, and often to the skin and altered and thickened synovial membrane, together with contraction and rigidity of flexor

muscles and tendons, often also of fasciæ. Contraction and rigidity of muscles is often present in the fibrous and ligamentous forms of anchylosis. Such are the various conditions on which anchylosis may depend. In a practical point of view, the great point to determine is, whether the anchylosis be true or false, using the terms affixed to them by Brodhurst, in his clear and interesting work on the "Treatment of Anchylosis;" the term true being used to denote osseous or bony union, and false, to denote fibrous, whether within or without the joint; for it is important to determine, not that the adhesions are intra or extra-capsular, but that they are fibrous. Before anæsthetics were brought into general use, Bonnet stated that "we have not any certain signs by which we can recognise bony anchylosis." Almost all observers will now, I think, concur with Brodhurst, who says, "Generally, however, when true anchylosis exists, the sensation on grasping the limb above and below the joint, and in endeavouring to move one part on the other, is unmistakeable; the sensation of solidity which is communicated under these circumstances is never felt when the adhesions are fibrous. Yet, as bony anchylosis is the exception, but fibrous adhesions exist so commonly, as to constitute the rule, the full effect of chloroform should always be obtained before anchylosis is pronounced to be bony. Indeed, I know no certain test which will enable true and false anchylosis to be at once distinguished, except thepeculiar and unmistakeable sensation which is communicated by solid bony union. But this is certain, that, when the slightest motion exists, union is not bony. And again, when the muscles about a joint are rigid, or the tendons are tense, union is not bony."

Treatment.—Anchylosis should on no account be interfered with, until all diseased action has ceased, and the parts have returned to a quiescent state. The slighter forms of anchylosis may be cured by friction, shampooing, steam-baths, by a splint with hinge and screw applied so as gradually to strengthen the joint, and by passive motion, in the employment of which the operator must bend and extend the limb with sufficient force to cause a little yielding, but little or no pain. These means, however, are likely to be successful only in the simpler forms of anchylosis. For making more clear the more energetic modes of treatment, it may be stated that they differ according as the adhesions are fibrous or osseous. In fibrous anchylosis, Brodhurst has clearly demonstrated that adhesions may be safely ruptured by forcible extension, and that motion can be successfully restored. Cases suitable for this operation are divided into two classes, namely, those in which muscular contraction exists to so great an extent as to prevent forcible extension having any effect upon the adhesions until the tendons and fasciæ have been subcutaneously divided; and those in which the adhesions may be ruptured by forcible extension without previous division of tendons and fasciæ. In the first class of cases, tendons should first be subcutaneously divided, the wounds should be allowed to heal, the patient brought under the influence of chloroform, the adhesions ruptured by forcible extension, bones replaced in their proper position, the limb placed in an easy splint in a proper position, preserved at perfect rest, treated as a recent severe sprain, until all inflammation has subsided, and quiescence completely restored, and then passive motion should be cautiously employed. In the second class of cases, the same treatment is instituted, with the exception that subcutaneous section of tendons is omitted. That this treatment is safe and successful in skilful hands, the gratifying results given by Brodhurst prove incontestably. I shall give the statistics in Mr. Brodhurst's own words :—"Of 32 cases which I have submitted to rupture, the following has been the result: in 11 instances, complete power of motion, or nearly complete power, has been gained; in 14, partial, but useful, motion has been restored; and in 7, the limb has been rendered straight, and the joint has remained stiff. Of the 11 first-mentioned cases, 8 were of the hip, 1 of the shoulder, 1 of the elbow, and 1 of the ankle. Of the 14 in the second series, 5 were of the knee, 4 of the hip, 2 of the elbow, 1 of the shoulder, and 2 of the ankle; and of the remaining 7, 4 were of the knee, 1 of the hip, 1 of the ankle, and 1 of the elbow."

The above gratifying results of the treatment practised by Brodhurst, contrast very favourably with those which followed the proceedings of Louvrier, of Dieffenbach, and of Langenbach. Louvrier applied rude force by means of a machine, so as to overcome muscular contraction, contractions of fasciæ, and adhesions, and laceration of muscles, rupture of arteries, and fractures of bones were the result. Dieffenbach was among the first to divide tendons subcutaneously, and he immediately after dinner extended the limb forcibly; the consequences were, that the wounds were made to gape, the integuments became lacerated, and although some cases terminated favourably, in others inflammation, suppuration, and even amputation were the results. The treatment of Dieffenbach was also adopted by Palasciano, Bonnet, and others. Langenbach's treatment consisted in the use of forcible extension alone under the influence of anæsthetic agents, without division of tendons; but dislocations, it would appear, and other serious consequences, resulted from these violent proceedings.

In some cases of bony anchylosis, where the bands of bone were external and partial, motion has been restored by forcible extension; but as a general rule, cases of bony anchylosis are incurable except by operation, and in the great majority of cases ought not to be interfered with. I have, like many others, cut out the elbow joint in a case where the arm was straight, and converted a case of bony anchylosis into one with a passably useful joint. In anchylosis this is a justifiable and satisfactory proceeding, but for bony anchylosis of other joints a convenient portion of limb has in a few cases been restored by excision of a wedge of bone, and in some instances the establishment of a false joint has been arrived at by the employment of sufficient motion after removal of a portion of bone. This operation was successfully performed by Barton of Philadelphia, in 1826, for anchylosis of the hip, in 1838 for anchylosis of the knee; by Gibson of Philadelphia, in 1838, for anchylosis of the knee. In these cases the operation was successful, but I have not been able to obtain sufficient statistics to enable me to judge of its merits.

When the object aimed at in the treatment of some diseases of joints is to obtain anchylosis, the maintaining of the joint in a serviceable position should be strictly enjoined.

HYSTERICAL AFFECTION OF THE JOINTS.

Hysterical females often complain of great pain in the joints, which might be mistaken for some real and dangerous disease of the part. According to Brodie, "At first there is a pain referred to the hip, knee, or some other joint, without any evident tumefaction; the pain soon becomes very severe, and by degrees a puffy swelling takes place, in consequence of some degree of serous effusion into the cells of the cellular texture. The swelling is diffused, and in most instances trifling; but it varies in degree; and I have known, where the pain has been referred to the hip, the whole of the limb to be visibly enlarged from the crista of the ilium to the knee. There is always exceeding tenderness, connected with which, however, we may observe this remarkable circumstance, that gently touching the integuments in such a way as that the pressure cannot affect the deep-seated parts, will often be productive of much more pain than the handling of the limb in a more rude and careless manner. In one instance, where there was this nervous affection of the knee immediately below the joint, there was an actual loss of the natural sensibility; the numbness occupying the space of two or three inches in the middle of the leg. Persons who labour under this disease are generally liable to other complaints, and in all cases the symptoms appear to be aggravated, and kept up by being made the subject of constant anxiety and attention."

Treatment.—Unfortunately for the patient, this affection is sometimes treated for a diseased or injured joint by antiphlogistic measures, which necessarily aggravate the symptoms. Constitutional remedies are those to be relied on. All of the functions are to be restored to a healthy condition, particularly the menstrual and digestive, since these will be usually found at fault.

Hygienic remedies are more valuable than local. "The patient should have fresh air, generous living, and plenty of occupation for mind and body; she should be encouraged to take exercise, notwithstanding pain and weakness; and to resume, as far as possible, the habits of a healthy person." The shower-bath and frictions of the skin will improve the capillary circulation. Tonics, such as quinine, valerian, and iron, will be found most valuable where there is debility. Brodie has also found benefit in the use of assafœtida injections, and in the enveloping of the joint with a plaster composed of equal parts of extract of belladonna and soap plaster. Applications of aconite and atrophine are often of great service for subduing the pain when very severe; and the employment of electro-magnetism and cold douches have often been found perfectly effectual to cure this affection when other means have proved of no avail.

SPRAIN OR STRAIN.

When the ligamentous apparatus of a joint is stretched, or partially torn, without displacement of the articular surfaces, it is said to be sprained or strained. These injuries are exceedingly painful; the pain is often of a sickening character, and is rapidly followed by great swelling, caused by extravasation of blood, serous effusion in and around the joint, and afterwards by inflammation and infiltration into the joint and surrounding tissues. The collapse attending a severe sprain is often as great as after a dislocation. The indications to be fulfilled by treatment are the prevention, diminution, and removal of inflammation; and when all inflammation has passed away, the removal of stiffness, and affording of support to the joint. In the first instance, elevation of the joint, perfect immunity from motion secured by means of a splint, and the energetic application of cold are the best applications for the prevention and diminution of extravasation. Cold applications must be changed for warm on the accession of the inflammatory process, along with other antiphlogistics, and after the perfect removal of all inflammation, friction, gentle support of a bandage, and cautious rubbing are useful for restoring motion and promoting absorption; but these means must be employed warily, lest any inflammation should again be induced. I have often been much struck with the advantage derived in sprains from the copious application of a lotion of the tincture of arnica and water. The tincture must be well diluted to prevent it from irritating the skin. When the violent pain that immediately succeeds the injury has passed away, the arnica seems to promote absorption, and diminish uneasiness to a great extent.

WOUNDS OF JOINTS.

Wounds of joints rank among the gravest injuries, and are not unfrequently followed by destruction both of limb and life; traumatic arthritis and its effects being the local conditions to be feared, and the violence of the irritative fever and pyæmia being the principal ways in which such injuries conduct to death. Wounds of small joints are often recovered from; and also wounds of large joints, in young persons of sound constitution, are often recovered from; but in grown-up persons, especially in those who from any cause are debilitated, or whose constitutions are irritable, or who have disease of the kidneys, the worst of results are to be apprehended.

All exploratory proceedings by the probe or the finger, with the view of ascertaining if penetration of joint has been effected, would be in the highest degree reprehensible. The evidence of penetration is usually but too evident from the history of the injury; the form of the weapon; the appearance of the wound; the escape of synovia; the urgency of the local symptoms of arthritis; the extent of the collapse in the first instance, and the severity of the irritative fever.

The local symptoms and state of parts are the same as in the most violent forms of synovitis, and need not again be described. The chief peculiarities being their severity, rapidity, and extent, and the great tendency to the early occurrence of suppuration.

If the wound be simple, incised, or punctured, and capable of being effectually closed, and the admission of air prevented by plasters and position, without sutures, the latter should be avoided. If sutures, however, be absolutely necessary, as a retentive means for closing the wound, they should be few, of silver wire, and introduced so as to include the skin only, and not to touch the synovial membrane. In the stage immediately succeeding the wound, the great object to be accomplished is, to prevent inflammation by the most rigid observance of the antiphlogistic regimen, by elevation of the joint, perfect rest, and the constant application of cold. Should inflammation supervene, or from the lacerated or bruised character of the wound be inevitable, it must be treated on ordinary principles. As the treatment is in all respects the same as that formerly described when speaking of acute inflammation of joints, it need not be stated in this place. One point, however, it is proper to mention, namely, that when suppuration occurs, in the event of the wound not being of a nature or in a situation to admit of free escape of the purulent matter, the early employment of free dependent incisions, so strongly recommended by Gay, should be resorted to; the limb should be placed on a splint, surrounded with a soothing poultice, and maintained in a position that would be serviceable should anchylosis eventually take place. The free escape of purulent matter tends to diminish the danger of pyæmia; and besides, in all cases of abscess of a joint, the removal of the pus is essential to admit of the possible occurrence of anchylosis. Instead of anchylosis, however, in these cases, after other dangers are got over, suppuration continues, hectic fever runs down the patient's little remaining strength, and secondary amputation becomes necessary.

LOOSE BODIES IN JOINTS.

Names.—These bodies were made a subject of inquiry by Ambrose Paré in 1558, and have since been referred to by various names, some of which are loose bodies in joints, inter-articular cartilages, osseous concretions, articular mice, and loose cartilages in joints. Rokitansky has given an interesting description of them under the appellation of articular mice; and according to Müller, they are improperly called cartilages, because, although they resemble cartilage in consistence, they are distinctly fibrous in structure. This point, however, will be referred to in an after part of their description.

Seats and Ordinary Characters.—These bodies are much more common in some joints than in others. They are exceedingly rare in orbicular joints; they are more common in the knee, elbow, wrist, and temporo-maxillary articulations; but their favourite seat is in the knee-joint. They present great varieties with regard to number, size, and shape. They are often single, and almost always so when large, but they are often numerous. In the living body I have never seen examples of more than two, and in most of the cases one, but I found 15 in the knee-joint of a body I opened in the dissecting-room while teacher of anatomy. The largest number I have ever read of being found in one joint was 60, and the largest number removed from a joint was 38. Berry of Kentucky removed 38, without any untoward occurrence, from the left knee of a coloured man, 35 years of age, who in early life met with an injury which was rapidly followed by swelling, and this continued until the date of the operation. In point of size, these bodies vary from the size of a millet seed to that of the dimensions of the patella, and even of a hen's egg; but they very rarely indeed are found so large, although a few examples are recorded. In point of colour, they are whitish, greyish, or of a yellowish-white; and with regard to shape they present great varieties, being found lenticular, ovoidal, and round. In the knee they are usually compressed, usually raised on one side and hollowed on the other, and in some cases, in point of shape, not unlike the patella.

Origin and Structure.—So far as I am able to judge, the opinions most generally entertained regarding the origin of these bodies, are those of Rokitansky, who describes two varieties of them, and believes they have different origins. The first variety, comprehending the fibrous or fibro-cartilaginous, some of which contain bony concretions, he believes to originate either in the cellular tissue, external to the synovial membrane, or in the substance of the synovial membrane itself. As they increase in size, they press the membrane into the joint, becoming covered with a replication of it; by and by they retain a communication with the membrane only by a small pedicle, a condition not unfrequently revealed by dissection;

and eventually, by the pedicles being ruptured, they become free in the joint. The next variety are fibrillated and albuminous precipitates, which are believed to take place in consequence of some morbid products in the synovial fluids ; they are distinguished by being of uniform consistence throughout, and by being formed of concentric laminæ. Solly successfully removed 8 bodies from the elbow joint; and Rainey has given so excellent a description of their structure, and of his opinion as to their mode of development, that I cannot avoid giving it in his own words :—

"These bodies," says Mr. Rainey, "have a distinct investing membrane, which on its external surface is smooth, but by its internal one is so intimately connected to the body itself as to admit of being detached only in small shreds. This membrane is composed of fibro-cellular tissue, mixed with granular matter.

"Their internal structure, as exhibited by a section through the middle, is seen by the naked eye to consist of two distinct substances, one being semi-transparent, like fibro-cartilage, the other being perfectly opaque and white, like bone. The former, under the microscope, presents the appearance usually seen in fibro-cartilage. The latter resembles remarkably in its ulterior structure those bones which consist of only one bony plate placed between two folds of membrane, as the thin plates of the ethmoid bone in the nose. In these bones the lacunæ, as in the opaque parts of the body before mentioned, are the same as in other bones, but there are no distinct or well-formed canaliculæ branching out from them. There is in both a stellate arrangement of the earthy matter around the lacunæ, but nothing like canaliculæ, and this appearance is more striking in the bones alluded to than in the earthy part of these bodies.

"I believe no satisfactory explanation has yet been given of the manner in which these loose bodies are formed in joints, although I think their origin, and the circumstance of their becoming loose in a joint, will appear obvious, by a reference to the remarkable character of the epithelium in joints, in the thecæ of tendons, and in mucous bursæ. This epithelium was described by me in a paper communicated to the Royal Society by Mr. Simon about three years since, but which has not been published. A few general observations upon this structure will suffice. It is situated in those parts of a joint, theca, or bursa, where it is least exposed to pressure. It consists of loops and convolutions of capillaries of various degrees of complexity proceeding from the surrounding vessels, and projecting into the synovial cavity. These capillaries are enclosed in sacculi of basement membrane, studded with minute oval cellules ; from the sacculi enclosing the capillaries, numerous other sacculi, into which no capillaries enter, proceed : these are of various forms and sizes, but generally they are attached to the primitive sacculus by an extremely long and slender filament of fibrous tissue, resembling the petiole of a leaf, the secondary sacculi being its expansion. Sometimes there are several series of these sacculi attached, one series to another, exhibiting an arborescent appearance, but in every instance the secondary sacculi are extra-vascular.

"I have found this kind of secretory apparatus in all the joints, as, for instance, the finger joints, the knee, shoulder, &c. Now this being the apparatus by which synovia is elaborated in all parts in which this fluid is found, and the bodies just described being found in these situations, they may be inferred to be the product of disease in these structures; the cellules of these fringes, in the place of elaborating synovia from the blood, producing, under the influence of morbid action, other products, such as cartilage, which becomes converted into imperfectly formed bone. The fact of the secondary sacculi being connected to the primary by extremely slender pedunculi, will suffice to explain the reason why these bodies may become formed in the first instance, the pedicle serving both to keep them attached, and to convey the material from the blood necessary for their development, until they acquire a certain size; but afterwards, from its tenuity, becoming no longer capable of holding them, it breaks, and the bodies become loose, and most probably cease to enlarge."

Symptoms.—The existence of loose bodies is often put beyond all doubt by their being felt, in consequence of their presenting themselves at the surface, and their most characteristic symptoms are sudden pain and faintness, followed by inflammation of the joint. The suddenness of the attack is very striking. While standing or walking, the patient is instantly seized with such violent pain as to be compelled to lie down, to save himself from falling; and sometimes the pain is so excruciating as to produce fainting. In consequence of frequent attacks, in many instances the joint becomes permanently weak, tender, and sometimes swollen.

Treatment.—The palliative treatment consists in giving support to the joint by means of a bandage or laced cap, with the view of preventing the body from slipping about; and if little inconvenience be experienced, it is more judicious not to interfere by operative proceeding; but in many instances so much pain and discomfort result from the presence of a loose body, as to make it justifiable to recommend radical treatment, which consists of the employment of some operation for its removal. The old proceeding of cutting direct into the joint was found attended with great danger to life and limb, and in consequence has long been abandoned. The operative proceeding which I believe is more generally resorted to than any other, is that which almost simultaneously was recommended by Syme of Edinburgh and Gogrand of Aix. The object of this is to avoid making a direct opening into the joint, and is accomplished by pressing the body up into one of the pouches of the synovial membrane, and then making a puncture through the skin at some distance from the body, sending down the mass subcutaneously, dividing the synovial membrane over the body, and pressing it through the wound in the synovial membrane into the cellular tissue, placing the joint in an easy position, closing up the wound of the skin, and after the wound in the synovial membrane has had time to heal, removing the body by cutting down upon it through the skin. In some cases it has been allowed to remain without inconvenience in its new situation. In but few instances, I believe, has this method of operation been followed with inconvenience. I cannot from personal observation say anything of this method, which is known to be satisfactory, as all cases I have seen in my own experience and in that of others have proved successful and in every way satisfactory after a different operation. They have all been cases of a single body in the knee-joint. The operation consists in placing the limb in a straight position, pressing up the body into a pouch of the synovial membrane, drawing the integument a little to either side, and then cutting down upon the body, when it readily springs through the wound. The parts are kept from moving in the least degree upon each other for a few minutes, until all oozing of blood has perfectly ceased, after which the integument is allowed to assume its natural position, the wound is closed, the leg carefully fixed upon an easy splint, and all judicious means employed to prevent inflammation. The wound is valvular after the operation, and I have not seen synovitis in any case after this proceeding.

CHAPTER XIII.

CURVATURES OF THE SPINE.

All curvatures of the spine may be comprehended under one or other of the three following heads :—

I. That in which the spine presents some unnatural curvature either backwards or forwards ;

II. That in which there is an unusual deviation from the mesial line, forming one or other of the varieties of lateral curvature ;

III. That in which there is a combination of both the preceding conditions, which is denominated mixed curvature.

The curvatures of the first class are subdivided into three varieties :—1st. Angular curvature ; 2nd. Posterior curvature, or excurvation ; 3rd. Anterior curvature, or incurvation.

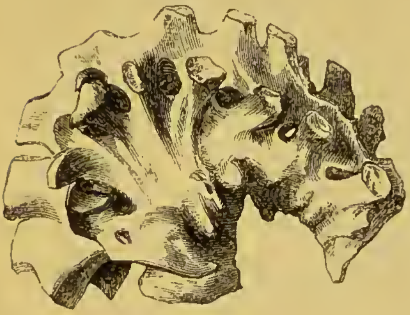
ANGULAR CURVATURE.

Angular curvature may occur in any part of the vertebral column, but its appearance is most frequent, its progress most rapid, and its existence earliest discoverable, in the dorsal vertebræ. In the cervical and lumbar regions, the vertebræ and intervertebral substances are deeper before than behind ; the reverse of which is true of the dorsal region. In the former, therefore, very considerable destruction must take place before the spine can lose its natural convexity in front and become concave ; but in the latter, the spine being naturally concave in front, angular curvature will be produced by a destruction much less extensive than in the cervical and lumbar regions. This form of curvature is more frequent in the cervical than in the lumbar region, and more frequent in the dorsal than in the cervical. It may occur at any period of life, though it is much more commonly met with in young persons, and seldom commences after the age of puberty, except when induced by some particular disease.

The state of the parts.—Angular curvature may arise from one or other of the four following causes :—

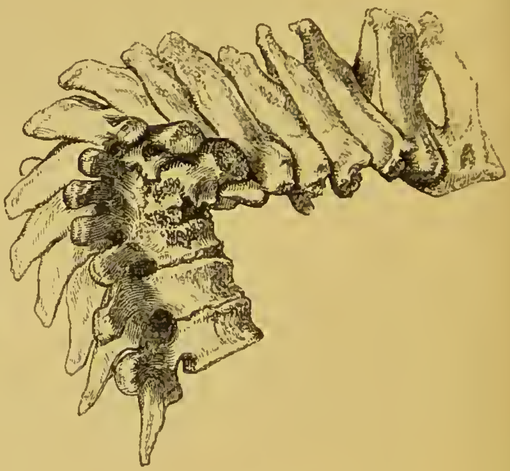
I. It may be the consequence of scrofulous caries of the spine. The bodies of the vertebræ, from their spongy texture, are peculiarly liable to scrofulous caries, the nature of which has already been fully explained. On this disease the great majority of cases of angular curvature depend. As the bodies of the vertebræ and the intervertebral substances form the part of the column which supports the superincumbent weight, when, in consequence of carious destruction, a chasm or gap is produced in front, the superincumbent weight sends the upper part forward, producing incurvation in front of the spine, and projections behind of the spinous processes. From the incurvation being of an angular form, the disease is denominated angular curvature. There is considerable variety as to the relative position of the two extremities of the diseased portion; sometimes the upper part falling forward comes to be directly in contact with the under part; sometimes it is otherwise; but this depends upon the number of the bodies of the vertebræ destroyed, and the extent of the destruction backwards. The spinal cord traverses the spinal canal, having its sheath in contact with the arches, and not the bodies of the vertebræ: that is to say, it directs its course along the greater curve. In most cases of decidedly marked angular curvature, complete or partial interruption of the functions of the spinal cord comes on sooner or later; the portion of the cord at the affected part of the spine is as far as possible from the bodies in front of it; but still, the bones do in some cases press upon the cord, and interrupt its functions, especially when the destruction has been rapid, and the curve is very abrupt. This cause of pressure and consequent paralysis may not be permanent. The projecting portions of bone may ultimately become smoothed down by absorption, and in some cases, this no doubt explains the discontinuance of the paralysis. The functions of the cord may also be interrupted by pressure upon the membranes, produced by matter formed in the progress of the disease. These are the causes, external to the membranes, which may occasion pressure on the cord, and interrupt the due performance of its functions. The same interruption, however, is often produced by results

Fig. 157.



Remarkable example of angular curvature and anchylosis. From a preparation in my museum.

Fig. 158.



Angular curvature from caries. From a preparation in my museum.

of inflammation, with which the membranes or the cord, or sometimes both, become affected; and in such cases there is usually found, on dissection, a thickened condition of the membranes, or the formation of matter between or within them, or a preternaturally injected state of the cord, or a softened condition of it, which may vary in degree from a slight deviation from the healthy appearance, to that state in which it is almost entirely fluid. Paralysis, however, has been known to exist where none of the above conditions, nor any morbid alteration of structure, was discovered on dissection; and Stafford and others suppose, that it is sometimes to be referred to longitudinal compressure of the anterior portion of the medulla. "The effect of angular curvation," Mr. Stafford remarks, "is the bending of the medulla and its membranes; which, as I have before stated, causes a greater or less degree of paralysis of the parts below, which, however, does not always arise from pressure of the bones upon it, but from the bending of its own substance, producing pressure upon itself; for instance, the anterior portion of the medulla would be compressed, while the posterior portion or back of it would be stretched."

It may be regarded as a general law, that of the two functions, voluntary motion and sensation, the former is almost invariably first removed, and the latter first restored, the rationale of which is, that the anterior columns of the spinal cord, which give off the anterior roots of the nerves, by which they preside over voluntary motion, are nearer to the seat of the disease, and therefore more exposed to pressure than the posterior columns which give off the roots presiding over sensation. Although pressure on the spinal cord is usual in angular curvature, it is surprising how nature, even in some cases where the destruction is very great, and the deviation from the natural form of the spine very remarkable, yet continues to maintain the integrity of the vertebral canal, so as to preserve the cord from being compressed. Of many examples of this remarkable fact I shall only refer to the following:—Mr. Stafford mentions the case of a child in whom, though the bodies of six dorsal vertebræ were destroyed, and the angle of the curve was very acute, paralysis did not occur. Professor Cruveilhier gives the particulars of a case in which the bodies of five dorsal vertebræ were completely destroyed; where the fifth dorsal vertebra rested on the eleventh, the two becoming anchylosed, and at a very acute angle; and yet the medulla was preserved free from pressure. I have at present under my care a girl ten years of age, in whose case the bodies of the fourth, fifth, sixth, and seventh dorsal vertebræ must be entirely removed; an abscess is formed, and is pointing about the middle of the seventh rib; and judging from the appearance of the spine behind, the parts above and below the seat of the disease must be for a short distance almost parallel with one another, so abrupt is the curve; and still the patient is as yet quite free from any symptoms of compression of the spinal cord. The only explanation given of such cases is, that the process of destruction must have been very slow, and the deviation from the natural form extremely gradual. Mr. Stafford remarks, "The completeness and incompleteness also of the symptoms very much depend upon the rapidity with which the curve takes place. If the destruction of the bodies of the vertebræ has been very quickly effected, the paraplegia is usually more complete; but if it has been slow in its progress, the paralysis below is often very imperfect."

In the progress of the disease, a collection of purulent matter forms, as in scrofulous caries in other bones, constituting what in some instances has been denominated lumbar or psoas abscess, but more properly spinal abscess. The appearance of abscess is an exceedingly unpromising symptom; it is, indeed, generally regarded as fatal. The period at which suppuration takes place differs greatly in different examples of this disease; in some it occurs at an early period, in others not for many months, or even for a longer period; and indeed an abscess is sometimes retained for years by the neighbouring parts becoming thickened and matted together. As a general law it may be stated, that the suppuration is much earlier when the curvature is induced by scrofulous caries than when it arises from other causes. The situations in which such collections point are various. When the abscess is connected with the cervical vertebræ, it may present itself among the muscles on the side of the neck, which is most usual, or it may be directed forwards, and burst into the pharynx, of which I have seen one example. When the abscess is connected with the dorsal division of the spine, it may present itself along the lateral part of the thorax, of which I have already mentioned one example, or it may point at other aspects of the parietes of the thorax by running along some of the intercostal spaces; but usually the matter follows the course of the posterior mediastinum, escapes under the diaphragm, and then descending along the course of the psoas muscle, points in the groin. Sometimes an abscess in the dorsal division forms a large swelling on the side of the abdomen, the matter descending between the peritoneum and the other structures which constitute the abdominal parietes. I had an opportunity of making a dissection in a case of curvature from scrofulous caries of the 7th, 8th, and 9th dorsal vertebræ, in which a spinal abscess, after following the course, first of the mediastinum, and then of the psoas magnus, burst at last into the under extremity of the sigmoid flexure of the colon. When the abscess is connected with caries of the lumbar vertebræ, it most commonly points in the groin near the insertions of the psoas magnus and iliacus internus muscles, or somewhere in the thigh below Poupart's ligament. In some instances, the abscess has shown itself in the loins, and in others in the nates, but these are comparatively rare occurrences. The only favourable termination which can take place in this disease is anchylosis, to which, however, the tuberculous condition of the bones is by no means favourable.

II. Angular curvature may result from destruction of the intervertebral substances,—the disease thence extending to the bodies of the vertebræ.

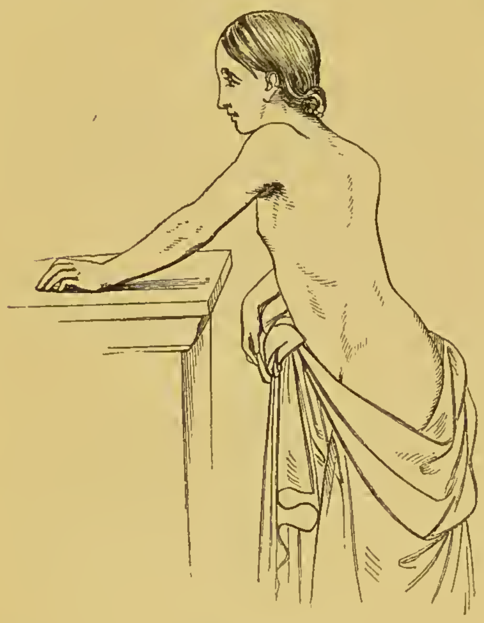
III. It may arise from chronic inflammation commencing in the vertebræ, followed by ulceration and caries; the vertebræ being like other bones, liable to inflammation. Such inflammation may be of a common character, causing common caries; or of a scrofulous character, producing scrofulous caries, already referred to; or of a rheumatic character, which may end in what has been denominated rheumatic caries. Destruction of the intervertebral cartilages is believed to be an early consequence of inflammation of the bodies of the vertebræ.

IV. It may originate in the softening and absorption of a vertebra without the production of any chasm. I have in my collection two very striking specimens of this condition, in both of which the curve is very abrupt, and yet there is no chasm or any trace of inflammation discoverable; and I have had under my care for several years a girl with angular curvature in the middle of the dorsal region, which case, from the entire absence throughout of any symptom, except the deviation from the natural form of the spine and the consequent alteration of the form of the chest, I consider to be one of this nature.

Symptoms.—These are divided into two stages:—1st. Before curvature; 2nd. During and after its formation.

In the first stage, the patient complains of a sense of weakness at the part of the back affected, and of weariness, and is unwilling to take exercise. After some time, a dull heavy pain is experienced during and after exercise. The pain, which at first is slight, becomes afterwards more severe, and is increased by exercise, by any sudden jerk communicated to the spine, and generally by percussion, and relieved by the horizontal position. From irritation of the spinal cord, there is often an altered sensation or occasional feeling of pain in the lower extremities; occasionally spasmodic twitches of the muscles, and at times spasmodic rigidity of the limbs. In the progress of the disease, and before the second stage, the muscles become wasted and lose the power of readily obeying the will, in consequence of which the patient cannot easily and quickly place his foot exactly on the spot where he may wish to place it; and when he walks, he is very apt to trip. There is coldness of the extremities, and fulness and tightness in the epigastric region; patients in this state often complain of a feeling of chilliness, and they are usually found to exhibit symptoms of a feeble condition of the general health. In the second stage, there are found the local symptoms of the first stage, often in an increased degree, and together with these, curvature, at first slight, but gradually increasing, and in form very abrupt,—a peculiarity most important to be remembered, as it is one of the best guides for distinguishing angular curvature from some curvatures which depend on a different condition, and in which, although the spine is bent backwards, the curve, instead of being abrupt and angular, is gradual, resembling a segment of a circle. There is angular projection posteriorly of the spinous processes, and the spine is bent forwards in consequence of destruction of the bodies of the vertebræ which support the superincumbent weight.

Fig. 159.



From a patient.

As the disease advances, the patient usually loses all sensation and motion in the parts below the point of pressure on the spinal cord; in short, he becomes affected with a paraplegia; the power of motion being generally first lost, and last restored, as explained in describing the state of the parts. The patient loses control over the bladder and the sphincter of the rectum, so that the urine and fæces pass off involuntarily; or if the pressure on the cord be very great, there may be complete retention of the urine. Slight difficulty of passing urine has often been found to be an early symptom. The easy performance of the functions of the digestive and respiratory organs is more or less interrupted; the bowels are generally constipated; and the patient complains of a sense of fulness and tightness at his stomach, and in many cases of pain. These conditions of the organs of digestion and respiration are supposed to be produced through the connexion between the spinal and ganglionic nerves; and this supposition is probably correct; but there can be no doubt that the function of respiration is often rendered difficult in curvature, in some situations, by pressure on the intercostal nerves, which are thereby rendered incapable of calling into action the intercostal muscles over which they preside, to assist in enlarging the chest in inspiration. To this point we shall afterwards have occasion to refer. In the progress of the disease abscess may appear; the situation where it shows itself varying, as formerly stated, according to the situation of the disease; its appearance is usually attended with increased derangement of the general health, and under the continuance of the discharge and irritation, hectic fever to a very urgent extent supervenes, and the bowels or some other internal organs becoming affected, death ensues. Such are, in general, the symptoms of angular curvature; but they differ considerably in different cases, particularly as to the local symptoms, which in some instances are as above described, while in others, there is no pain or tenderness—the only local symptom being the deformity. If the deformity depend on mere absorption, there may be no pain, but it is an important fact which should always be kept in view, that scrofulous caries of the spine, as is mentioned by some authors, and as I have several times found, may run its course, and yet the patient may not experience any pain or any local symptom beyond a sense of weakness and weariness of the affected part. So little pain is there, that in many instances the curve has been formed before the real seat of the disease has been suspected. In scrofulous caries there is generally less pain than when the disease originates in common caries; but suppuration usually takes place earlier. These differences, the history of the case, and the presence or absence of a scrofulous diathesis, will assist in forming our diagnosis. The symptoms of curvature vary according to the part of the spine affected. When it occurs in the lumbar region, and more especially towards its lower part, it is not usual, unless the disease be to a great extent, to find the altered sensations and spasmodic twitches in the early stage, or the paraplegia in the latter, as the great size and the form of the bodies render the contents of the canal less liable to pressure. When the curvature is in the dorsal region, the projection, owing to the great length of the spinous processes, becomes very marked. The chest becomes altered in shape, being flattened laterally, the ribs projecting backwards, following the vertebræ with which they are connected, and the sternum appearing too far forwards. There is at times palpitation, and in some instances difficulty in breathing, occasioned by compression of the intercostal nerves, or of the spinal cord above their origins; but this symptom is not so frequent when the curvature is in the dorsal as when it is in the cervical region. When it is in the cervical region, the head is bent forwards, the prominences behind are not large, unless the seventh cervical vertebra be involved, and the respiration is difficult. In the early stage, there may be pains and twitches of the muscles of the upper extremities as well as of other parts inferior to the seat of the disease. Sometimes when the disease is in the cervical region, especially in its upper part, it proves fatal by producing effusion in the brain; and in some cases the odontoid process having lost, in the progress of the disease, the attachments of the ligaments which keep it in its proper situation, presses on the spinal cord, and thereby causes immediate death, the seat of the pressure being higher up than the origins either of the phrenic or of the intercostal nerves which preside over the actions of the muscles of respiration. Having thus given a short account of the symptoms of angular curvature of the spine generally, and the symptoms peculiar to curvatures in particular situations, we shall next refer very briefly to the treatment.

Treatment.—Any attempt to remove the curvature would be most injudicious. Anchylosis is the only favourable termination to be hoped for, and therefore the object aimed at in treatment should be, to place the patient under the circumstances most likely to conduce to that result. With that view it is indispensable, first, to keep the patient in a recumbent position, so as to remove from the diseased parts the pressure of the superimposed weight, and to preserve the parts as much as possible in a state of perfect quietude in that position; and secondly, to use all means, judicious and available in the circumstances of the case, for maintaining the general health. In some cases, local remedies are highly beneficial.

That it is necessary to confine the patient to the recumbent position does not admit of question, for it is evident that the superimposed weight pressing on the diseased part, must not only act as a source of irritation, but must also tend to increase the curvature; and it can only be effectually removed by placing the body in the horizontal position. And that any effort which nature may make to effect anchylosis may not be defeated, it is further necessary that the parts should, as much as possible, be prevented from being moved upon each other. Another advantage which results from preserving the parts at perfect rest in the horizontal position is, that the removal of the irritation, caused by the superincumbent weight, from the diseased parts, diminishes the danger of the formation of abscess, which is a most unpromising occurrence, and must induce the gloomiest apprehensions as to the ultimute results. One of the best means for fulfilling the above indication is, to place the patient in the supine position on Earle's bed, which, besides other advantages, rendering it very convenient for this part of the treatment, allows the relative position of the trunk and limbs with regard to each other to be slightly changed, without any risk of moving the diseased parts on each other. The slight change thus allowed renders the confinement to the recumbent position much less irksome than otherwise it would be. As an additional precaution for preserving the diseased parts from any movement, it is advisable to use a suitable spinal instrument, and when such cannot be obtained, to apply splints on each side of the spine. The splints in such cases must suit the shape of the parts to which they are applied. Some recommend the patient to be placed in the supine posture, but others give the preference to the prone position, because in that attitude the superimposed weight is more effectually removed,—there is no risk of heat and irritation from pressure,—it favours the return of venous blood from the bodies of the vertebræ,—and the approach of paralysis, it is thought, may be deferred, as matter will gravitate away from the medulla. This position is also very convenient when local applications are necessary, and in some cases the curve is so abrupt, that it is almost impossible with every precaution to keep the patient long on his back without producing irritation of the soft parts. But notwithstanding the above-mentioned advantages, I confess I have, in the majority of cases, found treatment conducted in the supine posture more satisfactory, and chiefly, I believe, from the diseased parts being more easily preserved in a state approaching to complete immunity from motion, than is possible when the treatment is conducted with the patient in the prone position, in which I have often been annoyed by finding it impossible to prevent the patient from moving the upper part of the spine by frequently moving the head and shoulders; and as far as my experience goes, the supine position is preferred by patients. Rest, however, of the diseased parts, and the recumbent position, whether the body be prone or supine, are of the utmost importance from the very commencement of the disease, until a cure is effected by anchylosis. When it is believed that anchylosis has taken place, and the patient is allowed to resume the erect attitude, it is a judicious precaution to employ for some time some or other of the admirably contrived spine supporters now in use, for removing the superincumbent weight.

The maintenance of the general health is another and equally important indication, but unfortunately some of the best means for fulfilling it are not compatible with the rest and the recumbent position which form essential parts of judicious treatment. The great importance of attending to the general health must be evident, when it is considered under what circumstances scrofulous deposits are most apt to take place in bone. In individuals of a scrofulous diathesis, insufficient or unsuitable food or clothing, living in a damp and cold or impure atmosphere, want of exposure to the sun's rays, mental depression, and any cause of debility, have unquestionably an influence in exciting scrofulous deposits in bone, as well as in other textures. These considerations suggest the inestimable importance of using all the means for improving the general health which were recommended when speaking of tubercle and tubercular disease of bone. Besides these means, in some cases local remedies are necessary; but the employment of them will depend on the cause of the disease. If the disease depend upon scrofulous caries of the vertebræ, or upon softening with absorption without ulceration or caries, depletion would be worse than useless, and would tend to weaken the patient. In these cases, the surgeon must content himself with advising the recumbent position, maintaining the diseased parts in a state of quietude, and prescribing all suitable means for preserving the general health. In scrofulous caries, benefit will often be found to accrue from the early and very cautious employment of counter-irritation, along with the treatment here alluded to. If the curve arise from inflammation of the bodies of the vertebræ, slight local depletion by leeching or cupping at the commencement of the disease, and afterwards counter-irritation, are known to be highly beneficial. The repeated application of small pieces of blister to each side of the vertebral column at the seat of the disease has been found well suited for children, and caustic issues for adults. Of the various means for producing counter-irritation, Mr. Pott gave the preference to caustic issues. I have used them very frequently, and in many instances with gratifying results. The greatest care must be observed not to produce much discharge, as that would tend to weaken the patient; and besides, the long continuance of a profuse discharge and of irritation might induce hectic fever. If abscesses form, the issues should be discontinued. Mr. Pott, whose valuable works contain many cases of disease of the spine, attended with paralysis, successfully treated by the application of counter-irritants, was the first who pointed out to the profession the results of such practice, and many have since followed it with equal success. Several years ago I ceased to attend a patient, in whose case I was much gratified with the result of using caustic issues, together with rest and the recumbent posture; and I refer to the case as a striking example of the complete restoration of sensation and the power of motion of the lower limbs, after they had been for eighteen months considerably affected, and for eleven months entirely lost.

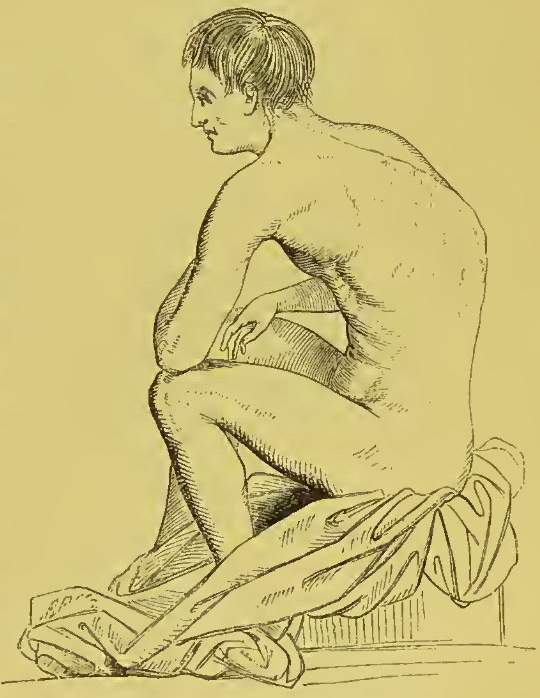
The patient, who was thirty years of age, had suffered for a considerable time from pain and a sense of weakness in his back; he afterwards became affected with angular curvature, in the middle of the dorsal region, and after the usual train of symptoms, ultimately lost all sensation and power of moving the limbs. The power of motion was first lost, and sensation was first restored; but the loss of both sensation and motion was as complete as possible. When I first saw him, he had lost the use of his limbs for several months, and the curve was rather abrupt, and involved three of the dorsal vertebræ. After treatment had been employed for four months, the sensibility of the limbs began to return, and ultimately it became perfectly natural, and this was followed by a restoration of the power of motion; and for two years the patient has been in every respect perfectly well, without any remains of the disease except the curve. I am satisfied that anchylosis has taken place. The case is interesting, as affording a remarkable confirmation of the fact, that the functions of the spinal cord may be for a long period completely suspended, and yet afterwards perfectly restored.

Some have gone so far as to affirm, that issues and counter-irritants are of no use whatever in this disease; an assertion which can only be explained by the want of success consequent on their injudicious adoption.

POSTERIOR CURVATURE, OR EXCURVATION.

Causes.—This distortion may be the consequence of scrofula, rickets, or mollities ossium, or of common or specific inflammation affecting the spine; or it may arise from a softened condition of the spine, or from debility consequent on mesenteric disease, or from weakness of the muscular system, however induced, or from constantly or frequently keeping the spine in an improper attitude, as is the case with studious persons, who contract a habit of leaning over books, or with clerks who have not been careful to avoid stooping while writing, or with individuals belonging to certain trades, as printers, or watchmakers; or it may be, as is often observed in girls, a consequence of a careless manner of allowing the shoulders and arms to hang forward. But whatever may be the primary exciting cause, the curvature will in almost every instance depend, 1st. On general caries of the anterior surfaces of the bodies of many vertebræ, the result of either common or specific inflammation; or, 2nd. On compression of the bodies of the vertebræ from softening; or, 3rd. On weakness of the muscles that support the spine; or, 4th. On combinations of some of the preceding conditions.

Fig. 160.



Excurvation of spine.—From Tuson.

Symptoms.—Either a part or the whole of the spine may be affected. There is an unnatural rounded prominence on the back, the distinguishing peculiarity of which is the absence of that abruptness which is found in angular curvature. If the curve be situated in the cervical region, the chin falls towards the sternum, producing what is commonly called "the stoop." When the whole spine is affected, forming a semicircular curve forwards, the patient, when sitting, is disposed to support his trunk, if the disease be not far advanced, by placing his hands upon his knees; and, if it have made considerable progress, by placing his elbows upon his knees; and when walking, he has an inclination to rest his hands on anything which he may be passing, to enable him to bear up under the superincumbent weight, which becomes very overpowering. The local and general symptoms vary according to the state of the spine on which the curvature depends, and the condition of the body in which it takes place. From the gradual form of the curve, the functions of the cord are not interrupted.

Treatment.—In considering what kind of treatment is proper, the surgeon must be guided by the nature of the cause of the disease. If the distortion depend on general caries, then the same treatment as in angular curvature is suitable. If it occur as an effect of rickets, or syphilis, a most important part of the treatment consists in the employment of the remedies adapted for these constitutional diseases. When it arises either from a softened condition of the vertebral column itself, or from weakness of the muscles necessary for maintaining it in the erect position, the surgeon should endeavour, by strict attention to the general health of the patient, to invigorate his frame. To effect this, pure air—generous diet—wine, or any other stimulant that agrees with the patient—tonics, of which the preparations of iron will, in many cases, be found among the most useful—and sea-bathing, should be enjoined. If sea-bathing be inconvenient, salt ablutions, or sponging the body with salt water, may be substituted for it. The regular and daily use of friction by means of the hair-glove or flesh-brush, and exercise on foot, should also be adopted. The patient should never take so much exercise as to induce weariness, and he should afterwards assume the recumbent position, until he experiences an aptness or fitness for further exercise. The surgeon should also recommend friction, with some stimulating embrocation, along the spine, and properly conducted exercises for strengthening the muscles of the back.

In curvature depending upon caries of the spine nothing could be worse than these exercises; hence the importance of diagnosis. When the curvature arises from bad habits, as constantly leaning forward, allowing the shoulders and arms to hang forward, or from an employment in which the spine is bent forward, the habit must be corrected, and the employment which produced the curvature must for a time be discontinued. In many cases mechanical support is advisable, and it may be given by some of the admirable appliances now in use, without confining the parts, or inducing injurious pressure in any way.

ANTERIOR CURVATURE, OR INCURVATION.

This, which happily is the rarest of all the curvatures of the spine, is remarkable for the rapidity with which it proceeds, when it has once commenced. It may happen as the consequence of rickets, mollities ossium, common or scrofulous inflammation; or, it may arise from a softened condition of the vertebral column, or from any state which so deranges the due balance in the action of the muscles maintaining the spine in its proper attitude, as to render the extensor muscles of the vertebral column too powerful for their antagonists.

The treatment consists in the application of the principles already laid down for the treatment of these particular conditions.

LATERAL CURVATURE.

This is by far the most common of all the curvatures of the spine, and is more frequently met with in girls than in boys, in the children of the wealthy than in those of the poor, and much more frequently in the females of this climate than in those who live in warmer latitudes. It seldom commences after the age of puberty, except when induced by the excessive action of the muscles of one side. That girls are more liable to it than boys is, no doubt, owing to the serious defects in their physical education. The injudicious means adopted for improving the figure by preventing the proper play of the muscles of the trunk, by retarding the development of the bones and muscles, and by producing more or less absorption of them by compression, cannot but be highly injurious; and to these causes, aided by the want of proper exercise, and of sufficient exposure to the open air, is to be referred the frequency of this disease in girls—causes which more frequently affect the wealthy than the middle and lower classes. The comparative rarity of lateral curvature as a primary form of disease among the poor, is proved by general experience, and by the statistical fact, that of thirty-two thousand nine hundred and ninety-one patients who presented themselves for relief at Middlesex Hospital in five years, there were not more than twenty affected with lateral curvature as a primary disease. As a secondary result arising from other affections, such as disease of the hip, or disease of the knee, lateral curvature is frequently found among the poorer classes. It seems to be the want of attention to this distinction which has induced some to question the fact of the comparatively rare occurrence of lateral curvature among the poor. The comparative exemption from this disease in the females of warm climates has been attributed to the loose clothing they are obliged to wear, allowing the due development of their various organs, to the want of stays, and of many injurious restraints, and to their not being subjected to the fatiguing confinement of an irksome position, as the young ladies of this country often are daily for many hours together, in acquiring a variety of accomplishments.

Causes.—The principal predisposing causes are rickets, mesenteric disease, a softened condition of the bones of the spine, compression of the thorax from tight lacing, weakness, especially when consequent on measles, whooping-cough, or other infantile diseases, want of proper exercise and exposure in the open air, and any circumstance which acts unfavourably on the general system before the various organs have attained their full development. Tight lacing is not uncommonly a predisposing cause of distortion of the spine. This custom, restraining the actions of the muscles, prevents their natural development, so that they become attenuated; the bones also to a certain extent become diminished by absorption, so as to be unable to sustain the weight they were destined to support; and the cavity of the thorax is diminished, in consequence of which there is not sufficient room for the healthy and easy performance of the functions of the heart and lungs.

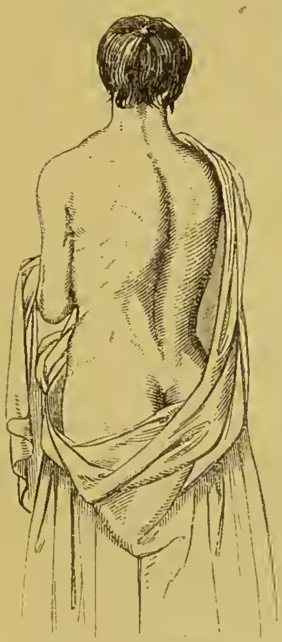
The immediate exciting causes are, the habit of standing on one leg; standing, sitting, or reclining in a position in which the spine is inclined too much to one side; injudicious confinement of a young person for a long time to one position without support to the back; the consequent weariness and irksomeness obliging the child to lean to one side to obtain relief; the disproportioned use of the muscles of one side, as in the case of persons engaged in certain avocations, or of children to obtain relief from the uneasy sensations caused by ill-made clothes, and lying on a soft bed with a very high pillow. These are the principal exciting causes of lateral curvature, and the rationale of their operation is sufficiently obvious.

When the distortion arises from the habit of standing on one leg, the first deviation from the proper shape of the spinal column takes place in the lumbar region, constituting what is termed the primary curve; and this will be followed by a curve in the dorsal region; which, to distinguish it from the former, is called the consecutive curve. If the convexity of the curve in the lumbar region be to the left side, that of the dorsal region will be to the right: so that if the distortion be to a great extent, the shape of the spine will somewhat resemble that of the letter S reversed: thus giving rise to the appearance of "growing out" of the right shoulder and left hip; but if the convexity of the curvature in the lumbar region be to the right side, that in the dorsal portion will be to the left, and the shape of the spine will more or less resemble the letter S, according to the extent of the contortion. The consecutive curve is the result of an effort to maintain the upright position; or, in other words, when a primary curve is formed in the lumbar region, the muscles on the opposite side of its convexity, and higher up, draw the spine in the contrary direction, and the one curvature compensating in a measure for the other, allows the centre of gravity still to fall upon the pelvis. The primary curve is always the bolder, and the consecutive curve may occupy the dorsal, and a considerable part of the cervical region; or there may be two consecutive curves in opposite directions, one in the dorsal and the other in the cervical region.

The same explanation may be given of the operation of several other exciting causes, such as the bad habit of standing, sitting, or reclining in an awkward attitude, or of leaning to one side to obtain relief from the weariness and aching sensations caused by too long confinement to one position. The disproportioned use of the muscles of one side is well known to be an exciting cause of curvature. Examples are occasionally met with in blacksmiths, dragoons, and in persons engaged in peculiar avocations, in whom the muscles on one side, from being frequently called into action, become so strong and so fully developed, as to overpower those of the opposite side, and draw the spine out of the perpendicular. Mr. Child records the case of a printer's apprentice, who was in the habit of frequently pulling the press with his right arm, and this gave rise to a curvature in the dorsal region with the convexity to the right side; the rhomboidei and trapezius muscles being tense, rigid, and prominent. In such cases the primary curve will be in the dorsal region, and will soon be followed by a consecutive curve in the reverse direction in the lumbar region. The improper use of the muscles of one shoulder is sometimes a cause of curvature in females. Mr. Stafford remarks, "A girl shall have ill-made clothes; for instance, one of the shoulder-straps will be constantly slipping off the shoulder; she, of course, will endeavour to replace it; by this effort she is obliged to elevate the shoulder, and thus she not only brings into action the muscles of that side, but at the same time inclines the spine to the one that is opposite. The effect of this position must be obvious, for on the one hand, she increases the power of the muscles on one side, which assist in pulling the spine out of the perpendicular; and on the other, the centre of gravity is destroyed." The above are the principal exciting causes, which acting separately, or two or more of them in combination, give rise to lateral curvature; but in some instances, the spine becomes distorted without any known exciting cause. Sometimes, although rarely, lateral curvature is found to depend on caries: in such a case, whatever excites inflammation about the spine may be an exciting cause of the distortion. I have in my own collection a good example of this condition, in which the primary curve is in the lumbar region, and is caused by caries of lumbar vertebræ. The possibility of this form of distortion depending on caries, suggests the necessity of great caution in forming our diagnosis. In such cases the curve will be more abrupt in its form, and more rapid in its progress than in the other varieties of lateral curvature. An excellent authority has given the following arrangement of the causes of lateral curvature:—1st. Debility, or muscular atony and relaxation of the spinal ligaments; 2ndly. Hypertrophy, as of the muscles of an upper extremity; 3rdly. Atrophy; the result of paralysis, of local inflammation, of amputation of an upper extremity, or of anchylosis of the elbow or shoulder; 4thly. Spasm of the muscles of the neck or back; 5thly. Obliquity of the pelvis, as is produced by unequal length of legs; 6thly. Rachitis; 7thly. Altered capacity of one side of the thorax; 8thly. Deficiency or excess of development of the bodies of the vertebræ.

Symptoms.—The spine exhibits unnatural, but seldom abrupt, deviations from the mesial plane. These are accompanied, more or less, with a sense of weakness and weariness, which, in some instances, increases especially towards night, and after exercise, so greatly as to become even painful, and to produce a desire to lie down in order to relieve the spine from the superincumbent weight. If the distortion depend on caries, which is exceedingly rare, there may be actual pain; but this state sometimes exists, as has been already stated, without the patient being sensible of any pain. The local appearances vary according to the extent, direction, situation, and number of the curvatures. If there be two curvatures, the one in the lumbar region, with its convexity to the left side, and the other in the dorsal, with its convexity to the right, there will be a falling-in of the right loin, a fulness in the corresponding part on the left side, and an appearance of projection and elevation of the hip; an alteration, also, in the form of the chest, which will be elongated, prominent, and round on the right side, and shortened and flattened on the left; the right shoulder will be elevated and project outwards, and the right mamma will be prominent; the left shoulder will fall down, and the mamma, from the flattened state of the thorax, appears smaller than on the right side. The rationale of these symptoms will be obvious, when the effects of lateral curvature upon the thorax are explained. Two of the most striking symptoms are the "growing out," as it has been called, of the right shoulder, and the prominent and elevated appearance of the hip. The extent of the above symptoms will correspond with the boldness of the curvature. When the convexity of the lumbar curve is to the right side, and that of the dorsal to the left, the appearances which in the former case were observed on the right will be found on the left side, and *vice versâ*. The above are the symptoms of lateral curvature, when there are only two curves, and these situated as described, and not of a very great extent. In an advanced stage, however, of this

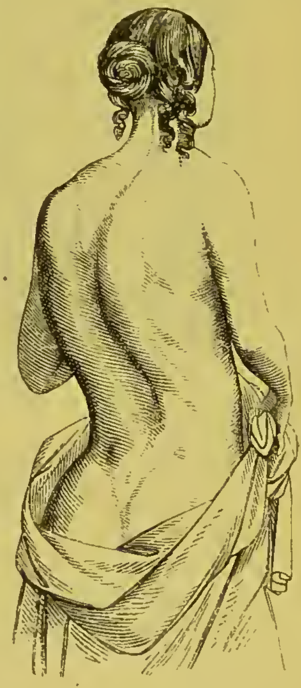
Fig. 161.



From a patient.

disease, an alteration is observed in the symptoms; the breast, like the scapula, does not remain prominent on the convex side of the dorsal curvature, but falls backward, in consequence of the ribs in front losing their convexity, and becoming flattened as the disease makes progress. If, however, there be three curvatures, and if a few of the superior dorsal vertebræ be, together with the cervical, involved in the uppermost curve, and if the distortion be considerable, the appearances will be different. Besides the symptoms already mentioned in the lumbar region, and the projection backwards of the scapula on the convexity of the dorsal curvature, there will be flatness of the chest and falling in of the neck on that side, together with fulness of the neck and breast, and elevation of the shoulder of the opposite side. In this variety, the scapula projects backwards at its lower, and falls forwards at its upper part, on the convex side of the dorsal curve; but it is not raised so much upwards as on the opposite side. The appearance is peculiar, from the projection backwards of the shoulder and the falling in of the mamma on the one side, and the rising of the shoulder, and the prominence of the mamma on the other. The convexity of the uppermost curve produces the fulness on the one side of the neck, and the explanation of the other peculiar symptoms is, that, on the side on which the mamma is prominent and the shoulder raised, the superior ribs are supported by the convexity of the uppermost curve, whereas those on the opposite side are connected with the concavity, and, therefore, fall in.

Fig. 162.

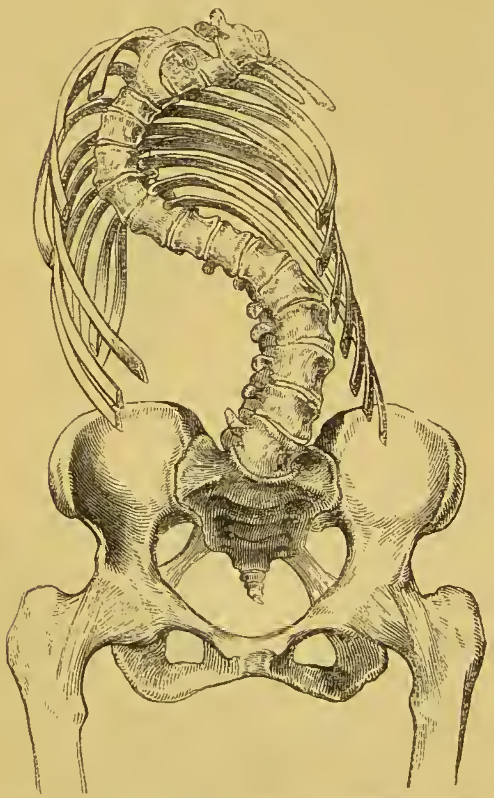


From a patient in my wards in the Royal Infirmary.

EFFECTS OF LATERAL CURVATURE ON THE SPINE AND ON THE TRUNK.

With reference to the vertebral column, it is observed that the effect of the curvature on the convex side is to separate the transverse processes from one another, to incline the spinous processes outwards, and to enlarge the bodies of the vertebræ and the intervertebral substances, so that they have the appearance of being expanded. On the concave side the reverse prevails; the transverse processes are brought too near each other, the spinous processes curve inwards, and the bodies of the vertebræ and the intervertebral cartilages are diminished in depth by interstitial absorption. The height of the column is diminished, and if the distortion be considerable, there is rotation of the spine to the same side as the curvature. The muscles which run along the convex side are inordinately stretched, and consequently weakened; while those on the concave side are preternaturally contracted and rigid. These alterations are not only to be discovered on dissection, but in the living body also. The surgeon can satisfy himself of the existence of these alterations both before and after dissection. If the curve originate in the use of one shoulder more than the other, the muscles extending from its convexity to the scapula will be preternaturally tense and large, when compared with those of the opposite side. There will be, on the concave side of the curve, flattening and shortening of the thorax, with diminution of the intercostal spaces; while on the other side, the thorax will be elongated and rounded in form, and the intercostal spaces enlarged, in consequence of the ribs being removed farther from each other. The condition of the ribs explains the symptoms observable about the shoulders and mammæ. The transverse measurement of the thorax is diminished, and, in consequence, the sternum usually becomes preternaturally prominent; and, in many instances, the diminished capacity and changed form of the cavity of the chest interfere with the easy play of the heart and lungs, and thus occasion to the patient annoying sensations within the chest.

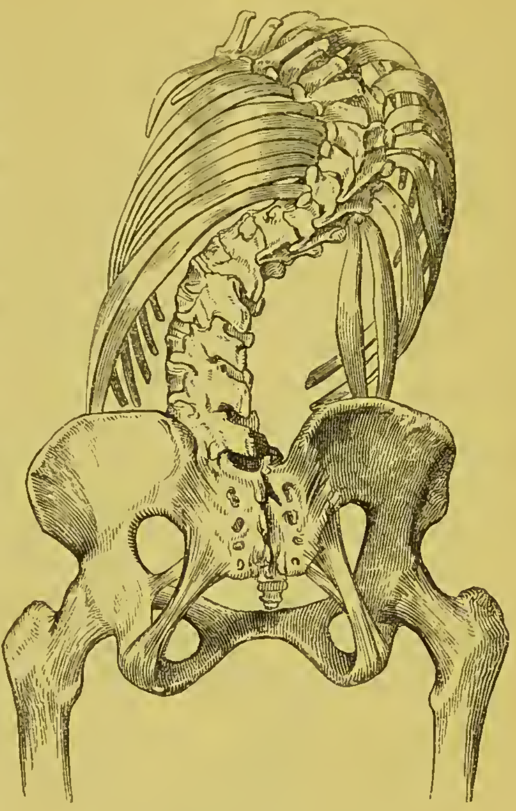
Fig. 163.



Front view of lateral curvature of spine. From a Preparation in my museum.

Treatment.—The treatment of this affection, when dependent on caries, which is extremely rare, consists in the application of the principles already laid down for the treatment of that disease of the spine. In the absence of caries and of anchylosis, the great objects to be aimed at in each case are the following:—1st. To determine the cause, and to remove it if possible. 2nd. To ascertain which is the primary curve, and to remove it. The removal of the compensating curve will be effected by the removal of the primary; and nothing could be more unscientific or injurious than directing treatment against the compensating curve. The only result would be increase of the primary curve; and hence the great importance of determining in each case which is the primary curve. 3rd. To aim at removal of the primary curve by unfolding it, or, in other words, by extending its extremities. This can best be done by raising the upper extremity of the curve, and supporting its convexity. The best means for thus unfolding a curvature is the spinal instrument recommended and used by Mr. Brodhurst. The idea of this spinal instrument was suggested to Mr. Brodhurst by Guérin's spinal chair, and Lonsdale's spinal couch, and the instrument was constructed by Mr. Everard. Mr. Brodhurst writes, "The instrument is novel; and the principle of action has never before been applied by means of a portable instrument to the reduction of spinal curvature. Too much praise cannot be awarded to Mr. Everard for the construction of this excellent instrument. It certainly is as admirably adapted for the purposes for which it is intended as could possibly be desired." 4th. After removal of the curvature, to strengthen the muscles of the back by the judicious employment of exercises suitable for the particular circumstances of the case. 5th. To use all necessary means for maintaining and improving the general health and strength. It would be presumptuous in me to speak in terms of praise of Mr. Brodhurst, but I may be allowed to say that the above principles of treatment will be found most lucidly described in his valuable work on "Lateral Curvature of the Spine."

Fig. 164.



Back view of same preparation.

MIXED CURVATURE.

As the various conditions on which curvatures depend, and the principles of treatment suitable to each, have been already explained, it appears unnecessary in reference to mixed curvature to say more than that the important point is, to ascertain the cause of the curvature, and to adapt the treatment accordingly.

CHAPTER XIV.

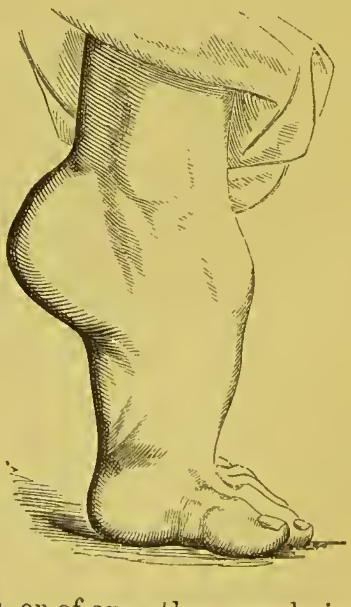
TALIPES, OR CLUB-FOOT.

THE word talipes, derived from *talus* and *pes*, was first used by Dr. Little as a generic term to comprehend all the distortions in which the foot deviates from its normal position. The principal varieties of these distortions are the four following,—namely, talipes equinus, or elevations of the heel, talipes varus, or inversion of the foot, talipes valgus, or eversion of the foot, and talipes calcaneus, or depression of the heel. There are also compound varieties, composed of combinations of two of these forms. The principal compound varieties are equino-varus, equino-valgus, varo-equinus, calcaneo-valgus, and calcaneo-varus. These distortions may be congenital or non-congenital. Talipes varus is much more common than any other form of congenital distortion, whereas talipes equinus, which is extremely rare as a congenital deformity, is by far the most common variety of non-congenital talipes. Brodhurst, in his excellent work on "Talipes," mentions that of 765 cases at the Royal Orthopedic Hospital, 688 were varus, 42 valgus, and 19 calcaneus. Talipes equinus did not occur once among the above-mentioned examples of congenital talipes. That it is extremely rare as a congenital affection, there can be no doubt. Tamplin says he never met with a pure example, and Lonsdale has stated that talipes equinus never occurs as a congenital affection. That it sometimes occurs as a congenital affection is evident from the testimony of Ammon, Duval, Guérin, Little, Brodhurst, and others, who have recorded cases which had existed at birth. Brodhurst has described one case which occurred in his own experience, and I have met with two instances of children born with talipes equinus of the right foot. In both examples the heel was raised about three-quarters of an inch, the tendo Achillis was tense, and the toes slightly flexed.

TALIPES EQUINUS.

Symptoms.—Talipes equinus is the most simple, though not the most common, variety of these deformities. It may vary from slight elevation of the heel to that position in which the heel is so drawn up, that the foot is almost in a straight line with the leg. The weight of the body in walking is borne by the anterior part of the foot, and in a pure example, equally by all the metatarsal bones; but in some cases where the toes incline slightly inwards or outwards, approaching somewhat to other forms of talipes, the anterior part of the sole of the foot cannot be applied evenly to the ground, and the weight is received chiefly by the metatarsal bone of the little or of the great toe, according as the tendency to lateral displacement is inwards or outwards. The inward tendency is the more common, owing, it has been supposed, to the circumstance that the natural configuration of the foot admits of more extensive adduction than abduction. In many instances, patients, when they stand carefully upon the affected foot, appear to tread evenly; but in walking, as soon as the foot is placed in the extended position, so that the posterior part of the astragalus, which is narrow from side to side, is received between the two malleoli, the foot inclines inwards, and the ball of the little toe principally sustains the superincumbent weight. There is great lateral mobility of the foot, especially in the extended position. The muscles of the calf are contracted, and the tendo Achillis is prominent, tense, and unelastic. These conditions are rendered still more apparent by any attempt to bend the foot; and the extent to which that can be done, and the amount of resistance offered, vary according to the extent of the distortion. The foot is unusually convex above and concave below, and in cases of considerable standing, the foot is smaller, and the leg, both in length and thickness, less, than on the opposite side, showing that the parts are less developed in every way. The gait of the patient is peculiar and unpleasing. Pain and a sense of weakness are often experienced at the instep from the strain on the parts in making exertion; and walking is often rendered still more disagreeable to the patient by painful corns forming on the parts on which he treads. In many cases the patient can, by a voluntary effort, slightly diminish the deformity; but when the distortion is caused by paralysis of the flexors of the ankle, he cannot by a voluntary effort bend the foot in any degree; and in such cases, if the surgeon place his finger over the belly of the tibialis anticus, or of any other muscle in front of the leg, and desire the patient to endeavour to excite it to contract, no motion whatever will be felt under the finger,—the volition is not followed by any change in the muscles, which the patient desires to call into action. This method of examination it is desirable to institute, before a prognosis be given, as the result of treatment is not likely to prove so satisfactory when paralysis is the cause. In a moderate degree of distortion unattended with paralysis of the muscles on the front of the leg, the toes are extended, as re-

Fig. 165.



presented in the accompanying figure. The metatarsal bones are somewhat separated from each other at their anterior extremities, where they bear the superincumbent weight, and at that part the foot is slightly broadened. When the muscles in front of the leg are affected with spasm, the toes are retracted upwards and backwards, and when they are paralysed, the toes are flexed and drawn backwards towards the calcaneum. The above are the symptoms which in a greater or less degree, according to the extent of the distortion, characterize this deformity. Talipes equinus congenitus is the name given to it when it exists from the period of birth; and talipes equinus acquisitus, when it takes place at a subsequent period.

ABNORMAL CHANGES.

The bones which present the greatest deviations from their natural condition are the astragalus, os scaphoides, and calcaneum, but chiefly the astragalus. They are generally somewhat diminished in size, especially the astragalus; and its natural articular facets for the bones of the leg are roughened and almost denuded of cartilage, while new ones are formed at a greater or less distance backwards according to the degree of the deformity: in the higher grades, these surfaces are furnished partly by the astragalus, and partly by the calcaneum. The head of the astragalus is diminished in size, and its articular surface for the os scaphoides is unusually small. The os scaphoides, which is also diminished in size but not altered in form, is drawn downwards; and hence the upper part of the head of the astragalus is prominent on the dorsum of the foot, and an unusual extent of the upper aspect of the bone presents itself, in consequence of the bones of the leg being removed so far backwards. The calcaneum is seldom fully developed. In the higher grades of talipes it furnishes a facet for the bones of the leg. The surface by which it articulates with the os cuboides is contracted in extent, and the upper and anterior part of the bone is prominent on the dorsum of the foot, in consequence of the os cuboides being drawn downwards. The remaining bones of the foot present their natural characters, except that they usually show more or less of deficiency in their development, and all the bones of the tarsus and metatarsus are so arranged, as to give the foot an unusual convexity above, and a corresponding unusual concavity below. The toes in most cases are extended, but Little has given a delineation of a curious specimen, in which the toes were unusually drawn downwards towards the calcaneum, which was owing to the circumstance that the person, to whom it had belonged, had not placed the foot upon the ground, but walked upon the knee. The presence or absence of paralysis of the long and short extensors of the toes determines the position of the toes. The articulating facets of the tibia and fibula are roughened in front and denuded of cartilage, from not coming into contact at these parts with the astragalus. The above are the abnormal conditions of the bones in talipes equinus. That which invariably exists, and is regarded as the distinguishing peculiarity, is a greater or less displacement of their articulating facets.

The ligaments in this and the other varieties of talipes are changed, being relaxed and shortened, so as to correspond with the situation of the bones. These alterations are now considered as consequences, not as causes of the deformity. Little remarks, "The ligaments cannot directly influence the production of the deformity; but its progress may be facilitated by their relaxation; the restoration of the foot is impeded by their diminished length, the result of long continuance in an improper position."

The muscles are, in all the varieties of talipes, invariably affected with abnormal conditions, which are regarded as the causes of these distortions. The distinguishing peculiarity is, that the balance between antagonistic sets of muscles is interrupted. The disturbance of the equilibrium of the muscles may arise from complete or partial paralysis of the tibialis anticus, or of it and of one or more of the other flexors of the foot, and the consequent contraction and structural shortening of the muscles at the back of the leg; or, it may be occasioned by the spasmodic contraction; and, if of long standing, the consequent structural shortening of the muscles of the calf, without paralysis of the muscles in the front of the leg; or, it may be unattended by either paralysis or spasmodic contraction, and be the result, as is often observed when the whole voluntary power of the limb is diminished, of the organic contraction of the extensors of the foot preponderating over that of the flexors.

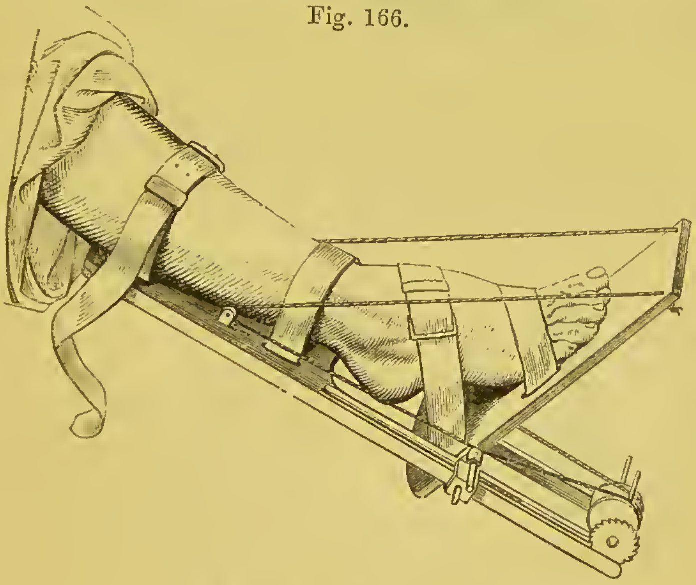
The gastrocnemii are the muscles chiefly involved in the production and maintenance of this deformity; and although sometimes other extensor muscles are affected, it is comparatively rare that the division of any of the tendons, except that of the gastrocnemii, is necessary.

These are the principal conditions of the muscles which cause genuine talipes; but deformities which in external characters resemble talipes, may arise from contraction of the gastrocnemii excited by abscess of the leg, or by caries or necrosis of either of the bones of the leg; from cicatrization of extensive ulceration; or, from the maintenance of the foot in a particular position, assumed in consequence of inflammation or other painful affections of the joints. In hysterical females, the signs of talipes are sometimes exhibited, constituting what has been called talipes equinus hystericus; and in many instances these symptoms have been found to subside under the treatment proper for hysteria. In cases where dissections have been made, the blood-vessels and nerves were found to be, like all the other structures, reduced in size; but, from what is stated above, it will be evident, that of all the abnormal conditions, that of the muscles must chiefly engage the surgeon's attention, as to that must be referred the existence of the deformity; and to the removal, therefore, of that condition, the remedial measures are to be directed.

Treatment.—An improved knowledge of the exciting causes of talipes, and of the abnormal conditions of the parts, has led to the adoption of sounder and more rational principles of treatment than formerly prevailed. In all cases of talipes equinus, whether congenital or acquired, whether induced by spasmodic contraction of the muscles at the back of the leg, or by paralysis of some of those in front, if structural shortening has occurred to any considerable extent, the proper treatment consists in the division of the tendons of the shortened muscles, and the restoration of the foot to its proper position, by means of mechanical apparatus. The nature of the operation and of the mechanical apparatus will be presently explained. In cases for which it is suitable, nothing more satisfactory can be desired than this method of treatment. By it I treated, with complete success, a case of talipes equinus of thirteen years' duration; and of the many successful cases recorded by Little in his treatise on this subject, the second had existed for fourteen years, the fourth for twenty-nine, and the fifth for thirty-five years, and yet the results were perfectly satisfactory. When the structural shortening is to a slight extent, the judicious employment of mechanical treatment, without division of tendons, will often prove efficient. In each of the two classes of cases, in that which requires the division of tendons, and in that which will yield to the judicious application of mechanical treatment alone, the origin of the disease should be minutely inquired into; and if the disturbance of the equilibrium of the muscles arise from paralysis of one or more muscles, the state of the central parts of the nervous system must be attended to; or, if by the reflex and incident functions of the nervous system, it has originated in disorder of the digestive apparatus, or in derangement of other organs, treatment must be directed to the removal of the cause, unless it has been of so long standing, or of such a nature as to preclude all hope of removal. In many cases, where there is no structural shortening, medical treatment directed to the origin of the disturbance, whether in the nervous system, the digestive apparatus, or in some other organs, will, by removing the origin of the disturbance, cure the deformity. In such cases an operation is not advisable, but it is prudent, together with medical treatment, to employ friction, manipulation, and such mechanical appliances as will be most likely to prevent structural shortening while the spasmodic contraction remains.

The operation is extremely simple, and the only instrument required for its performance is the tenotomy knife. It is very important that the wound of the integument should be the least possible. In talipes equinus, the tendo Achillis is usually the only tendon that requires to be divided, but in cases of long standing it is often necessary to divide the plantar fascia, the section of which, when required, should be made, and the longitudinal arch of the foot restored, prior to the division of the tendo Achillis. The division of the tendo Achillis may be effected in the following manner :—While the knee is extended and held by one assistant, and the heel depressed and the toes raised as much as the structural shortening will permit by another, for the purpose of rendering the tendon prominent and tense, the surgeon introduces the flat blade of the knife at either side of the tendon, and having passed it under the tendon until the point reaches the opposite side, turns the edge backwards, and divides the tendon in withdrawing the knife. The division is attended with a grating noise, and its accomplishment is evidenced by the removal of the resistance to the depression of the heel, and by the hollow that is left under the integument. Not more than a drop or two of blood escapes, and the external wound is extremely small, being not more than the breadth of the instrument, which is carefully withdrawn through the opening by which it was introduced. A small piece of plaster is placed over the opening, and the foot is preserved in its former position by means of a pliant splint, until the wounds be perfectly healed, which is usually not more than two or three days. As regards the operation, there is merely a puncture of the skin, and the division of the tendon is subcutaneous, so that neither the tendon nor its sheath being exposed, the danger of inflammation is greatly diminished; and that it may be yet further diminished, and the risk of suppuration avoided, no means should be taken to restore the foot to its proper position until the wound be perfectly cicatrized. Such is the doctrine laid down by Stromeyer, and followed by the most experienced orthopedic surgeons, as to the period at which extension

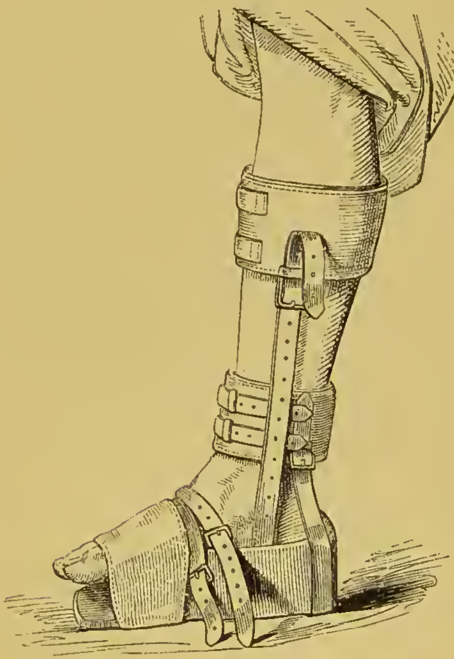
Fig. 166.



Stromeyer's apparatus applied.

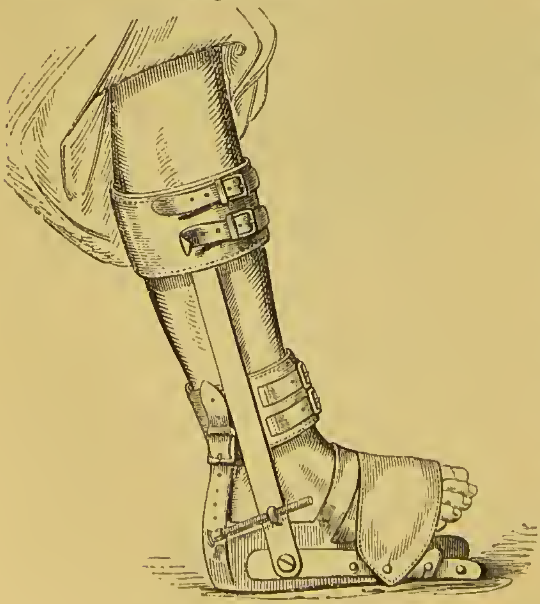
should be commenced. But Bouvier, Whipple, and some others, recommend that it be commenced immediately after the section of the tendons. There is also a difference of opinion as to the manner in which extension should be employed. Stromeyer, Little, following his example, and most others, bring the foot gradually to its proper position; whereas others endeavour to effect this at once. The directions of Stromeyer, both as to the period for commencing extension and the method of employing it, are those which have met with general approval. The extension having been commenced, should be daily increased, care being taken not to employ it injudiciously, or to apply so great a pressure as to cause abrasion or irritation, which might render continuance of the extension injurious. The extension is necessary for stretching the ligaments, for restoring the bones to their normal position, for elongating the muscles on the back of the leg, and for allowing, by bringing up the toes, the contraction of the muscles on the front of the leg, by which the foot is maintained in its proper position. Together with extension, bathing, fomentation, and friction should be daily employed, and will be found beneficial.

Fig. 167.



Little's boot applied. One view.

Fig. 168.



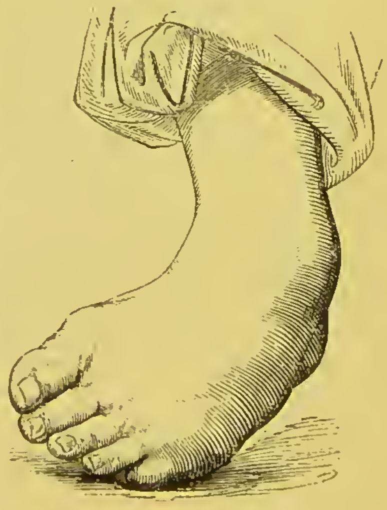
Little's boot applied. Opposite view.

Of the many kinds of mechanism contrived for the purpose of accomplishing extension in the various forms of talipes, Stromeyer's stretching board, and Little's apparatus, are most generally approved. The former is the more suitable for talipes equinus, and for some cases of talipes varus; but for others, Little's apparatus will be found more useful, as fulfilling more indications than the stretching board of Stromeyer. These pieces of mechanism, and the mode of their operation, may be understood from the accompanying woodcuts. The apparatus of Little is a modification, with various improvements, of one originally used by Scarpa. By means of mechanism the foot is gradually brought into its proper position, and the muscles that are undivided, the ligaments, and the lymph effused between the ends of the divided tendons, are cautiously extended. My friend and former pupil, Dr. Aveling, now practising in Sheffield, has contrived an admirable apparatus, which he calls a talivert, and this I have used for several years both in public and in private practice. It appears to me exceedingly well adapted for the purposes for which it is intended, and decidedly superior to all kinds of apparatus hitherto employed for the treatment of these deformities. It is equally useful in every form of talipes, and for some years I have not used any apparatus except pliant splints for infants, and Aveling's talivert in all cases where mechanism is required. I hope Dr. Aveling will make this useful addition to surgical mechanism known to the profession. When walking is resumed, care should be taken to place the foot properly on the ground. In this variety of talipes, walking, after the proper period, tends to prevent a return of the deformity and to perfect the cure; and it may be ventured upon earlier than in some varieties, which will afterwards be described.

TALIPES VARUS.

Symptoms.—While talipes equinus is the most simple, talipes varus is by far the most common congenital variety of these deformities. "It is that deformity in which the foot," as Little remarks, "undergoes a threefold alteration of its position in relation to the leg: extension, adduction, and a rotation of the foot, somewhat analogous to supination of the hand, taking place to a greater or less extent, according to the severity of the disease. The heel is drawn upwards (extension), the toe is turned inwards (adduction), and the patient treads on the outer edge of the foot only, the inner edge being raised from the ground (rotation). This threefold alteration from the natural position of the foot occasions the most serious impediments to steady or comfortable walking; and when the disease reaches the highest gradations, the foot assumes a frightfully distorted ap-

Fig. 169.



pearance." In many instances the distortion is so great that the sole of the foot is vertical instead of horizontal; and the patient, unable to apply any part of it to the ground, supports the weight on the outer edge of the foot. The patient, when standing, keeps the legs removed from each other, to balance the weight of the body; the gait is unpleasing and unsteady, and walking is rendered not only unusually fatiguing, but also very painful by the strain upon the foot and the swellings which form upon the skin on those parts on which the patient treads. The foot is preternaturally small, as well as the limb, from the want of proper development, and it deviates from the natural condition not only in its relation to the limb, but also in its shape; for its dorsum presents an unusual convexity, and the sole a corresponding concavity; its inner edge is short and unusually concave; its outer edge is convex, and in many cases has a semicircular outline, on the middle part of which only the patient is able to tread. The patient has no power to bend the foot by voluntary effort; the attempt to do so merely increases the adduction. When the deformity is slight, the foot may be brought into a natural position, but as soon as the force is removed, it returns to its former state. When the deformity is more extensive, the surgeon cannot, by taking hold of the foot, bring it into a proper position, and in the worst cases he can only move it slightly in the right direction.

For making more clear the characters and state of parts, four grades of this distortion are described. In the first, by no means the most common, there is simple retraction inwards of the anterior portion of the foot, and this may or may not be attended with diminution of the length of the foot. The inversion depends on retraction of the tibialis anticus, and the shortening of the foot, when present, on contraction of the plantar fascia. Guérin considers this slight distortion consisting simply of drawing inwards of the anterior portion of the foot as essentially varus. In the second grade, the toes are inverted, the inner edge of the foot drawn up, and the heel elevated. These alterations depend on retraction of the gastrocnemii and tibial muscles. In the third grade, the heel is elevated, the foot shortened, its anterior portion drawn inwards, its inner edge directed upwards, and its outer edge downwards; the sole of the foot is not only shortened, but unnaturally concave and irregular, and the extreme phalanx of the great toe is extended. The extensor proprius pollicis is retracted, and the muscles of the calf, and the anterior and posterior tibial muscles are so to a greater degree than in the second grade of this deformity. In the fourth grade, the inner edge of the foot is drawn upwards, and sometimes to an extent to be almost in contact with the front of the leg; the heel is drawn up; and the outer part of the dorsum of the foot is directed downwards or forwards, and is the only part, along with the upper edge of the outer aspect of the foot, that can be applied to the ground. The toes are approximated to the heel, and the tendo Achillis is deflected inwards. In addition to a greater degree of the state of the muscles than in the third grade, there is great relaxation of the extensors and abductors of the foot, and contraction of the flexors of the toes, and a rigid contraction of the muscles in the sole of the foot.

These symptoms may either exist at birth or arise afterwards; in the former case, they constitute talipes varus congenitus, in the latter, talipes varus acquisitus.

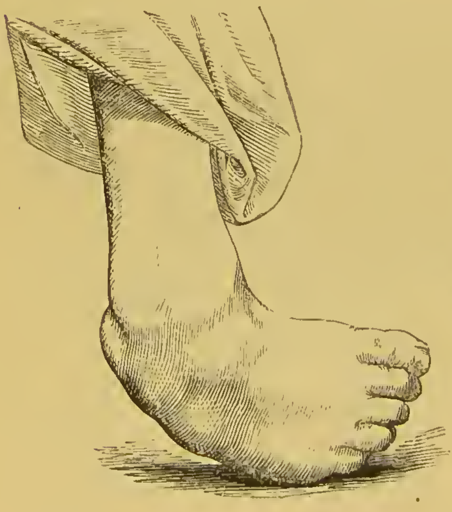
Abnormal Conditions.—In talipes varus there are the same abnormal conditions of the bones as in talipes equinus. This might have been expected, as extreme extension is common to both deformities. It is unnecessary again to enumerate these conditions: but there are also other changes in talipes varus, produced by the adduction and rotation. The changes, as in talipes equinus, consist principally of alterations in the relations of articulating facets to each other. According to Scarpa and others, the astragalus undergoes less alteration of position than either of the other tarsal bones. Although its articulating facets for the ankle joints are displaced by being pressed forward and outward, the portions of these surfaces towards the outer side being further displaced than those towards the inner, still some parts of its surfaces are in contact with some parts of the surfaces for the ankle joint furnished by the bones of the leg; and there is no condition calculated to prevent a cure, if the cause of the deformity be removed. It is, however, more or less displaced in two particulars—namely, both in its long and in its vertical axis. Its posterior extremity is drawn upwards, its internal surface is directed forwards, and its outer surface backwards. These changes are caused by its firm attachments with the calcaneum. The calcaneum is drawn upwards, by the gastrocnemius, so as to occupy in the higher grades almost a vertical position, and it is also slightly rotated; and the scaphoid, cuneiform, and cuboid bones not only present the same peculiarities as in talipes equinus; but they are also, by the adduction and rotation of the foot, twisted inwards and rotated on their own axes, so that their inner edges are in a measure directed upwards, and their outer edges downwards. The os scaphoides has been found so much drawn inwards, as to have its inner extremity articulating with the anterior part of the malleolus internus, and connected with it by a powerful ligament. The os cuboides, instead of articulating with the whole of the anterior part of the calcaneum, is more or less separated from it above, by being drawn downwards and inwards; and sometimes, when the deformity has been very great, they have been found in contact only at the under parts of their articulating facets—a triangular space, the base of which is upwards, intervening between them. In some examples of severe forms of the fourth degree of congenital varus, the tarsal bones have been found malformed, and with these malformations some abnormities of the brain or spinal cord have usually been found to exist. The above are the essential peculiarities of the bones in talipes varus. Palletta, Delpech, Cruveilhier, and others, have found the malleolus internus in some instances deficient in size ; and in one case, which came under my own observation, it was remarkably small ; but this condition does not always appear. The ligaments are adapted to the altered relations of the bones, and the stretching of those which are preternaturally short, is one of the causes of uneasiness in the restoration of the foot to its proper position, by the treatment after an operation. The abnormal conditions of the muscles and tendons are considerable and important, since it is by them that the deformity is produced and maintained. Some muscles are shorter, others longer than natural, and their equilibrium is disturbed. This disturbance may be produced in either of the ways mentioned in the description of the abnormal changes in talipes equinus. The number of muscles which are contracted varies in different degrees of the deformity. The muscles chiefly concerned in producing talipes varus are, gastrocnemii, tibialis anticus et posticus, and flexor longus digitorum. The gastrocnemii raise the posterior extremity of the calcaneum, and the tibiales, mainly instrumental in producing varus, invert the anterior portion of the foot, and draw up its inner edge. When the muscles are spasmodically contracted, their bellies feel firm and hard to the touch, like muscles affected with spasm ; but when the deformity is attended with structural shortening, the muscular tissue is in a state of atrophy, both its length and thickness being diminished ; and sometimes, though rarely, it is converted into a fatty substance, constituting what is termed the fatty degeneration. There is often shortening of the plantar fascia to such an extent as to require the division of its inner portion. This shortening, however, is not, as Maisonnabe believed, a cause of the deformity, although it often presents such an obstacle to the restoration of the foot to its proper position as to render division necessary. The appearance of the limb slightly resembles its appearance in a state of atrophy. Its temperature is often observed to be lower than natural, and on dissection the vessels and nerves, like the other structures, have been found unusually small. Of all the abnormal conditions, however, that of the muscles and tendons especially requires attention.

Treatment.—In determining the most prudent method for restoring the foot to its natural position, the surgeon will be guided by the same considerations as in a case of talipes equinus ; and, as the principles of treatment were fully stated under that head, it appears unnecessary to do more than to give some short particulars as to the treatment of those cases of talipes varus in which there is so much shortening of tendons, that their division is requisite, in addition to mechanical treatment, for reduction of the distortion.

In the simplest form of varus, the tendo of the tibialis anticus alone requires to be divided : but in the higher degrees, it is necessary to divide the tendons of the tibialis posticus, and flexor longus digitorum and tendo Achillis, together with the plantar fascia. I am well aware that some have recommended a different procedure, but my firm belief is, that the preferable proceeding is to divide the tendons in the following order : first, tibialis posticus and flexor longus digitorum ; second, tibialis anticus ; and third, after an interval of about three weeks, when the case is reduced to simple equinus, divide the tendo Achillis. The most convenient mode of dividing the tendons of the tibialis posticus and flexor longus digitorum, and that which is, I believe, generally adopted by the best orthopedic surgeons of this country, has been very distinctly described by Brodhurst in the following sentences :—"The patient should lie on his side, the inner side being turned uppermost, or towards the operator. The operator, standing or seated behind his patient, will endeavour to feel the edge of the tendon, or, if that be impracticable, the edge of the tibia. In fat children, it may even not be possible to define the edge of the bone. Under these circumstances, the knife may be inserted midway between the anterior and posterior aspects of the leg. The assistant, being placed opposite to the operator, steadies the foot and leg, at the same time slightly bending the knee. The knife is then to be inserted at the point indicated, from half an inch to an inch and a quarter, according to the age of the patient, above the inner malleolus, and to be carried perpendicular to the surface, on the fascia of the leg, which is to be divided close to the edge of the tibia. The opening of the fascia may be increased without enlarging that in the skin by using a lever motion of the knife. The sharp-pointed knife is then to be withdrawn, and to be replaced by a round knife, which is to be passed down by the side of the bone in the opening made in the fascia, to the distance of nearly half an inch. If the knife be held perpendicularly, and allowed to drop down by the side of the bone, it will be felt, with a slight lateral movement, to be between the tendon and the bone. The knife may then be very slightly withdrawn, and its edge turned towards the tendon. At the same time, the assistant will rotate the anterior portion of the foot downwards ; and the handle of the knife being slightly inclined, the tendons will be divided. The snap and yielding at the moment of division, will be felt and heard by the operator and his assistant. When, however, the tendons have been previously divided, probably no audible snap will occur, and the yielding will be less distinctly felt. Occasionally, when the tibialis posticus tendon is very tense, it lies on the edge of the tibia, and may be divided in that position by the sharp-pointed knife. Some operators use the sharp-pointed knife alone, for division of the posterior tibial tendon in its ordinary position, by the side of the bone. This practice is, however, attended with more danger to the artery than the mode of division above recommended."

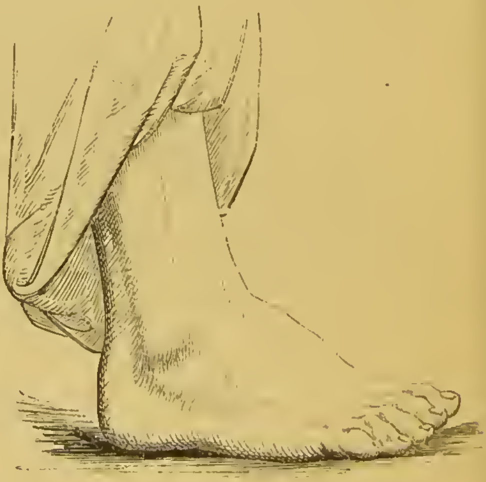
A dossil of lint is held upon the wound by an assistant, the patient is turned to his back, and the division of the tendon of the tibialis anticus is effected by the operator introducing a sharp-pointed tenotomy knife close by the outer edge of the tendon between it and the artery, carrying it a little under the tendon, and raising the edge upwards, the assistant at the same moment rotating the anterior portion of the foot downwards and outwards. Dossils of lint are placed over the wounds, a pliant splint is applied by means of a bandage, and the parts kept at rest for three or four days in the ordinary position before the operation, until the wounds are united. In three or four days, the lint and bandage should be removed; and if the patient be an infant, or if the case be congenital, and not of very long standing, all the apparatus required to overcome the inversion will be a pliant splint and a bandage. The splint should be applied to the outer side, and by means of a bandage the foot is brought sufficiently outwards. The cure, in the course of about three weeks, is thus reduced to that of simple equinus, when the tendo Achillis should be divided, and by the treatment already described for simple equinus, the whole of the distortion is speedily removed. When the resistance to be overcome is considerable, as in cases of long standing, I prefer Aveling's talivert to every other kind of mechanism in varus and every other distortion. The accompanying figures represent a foot before and after operation, in which the whole of the above-mentioned tendons were divided, and Aveling's talivert used; and last winter, I showed a little girl to the surgical pupils of

Fig. 170.



Appearance before operation.

Fig. 171.



Appearance six weeks after.

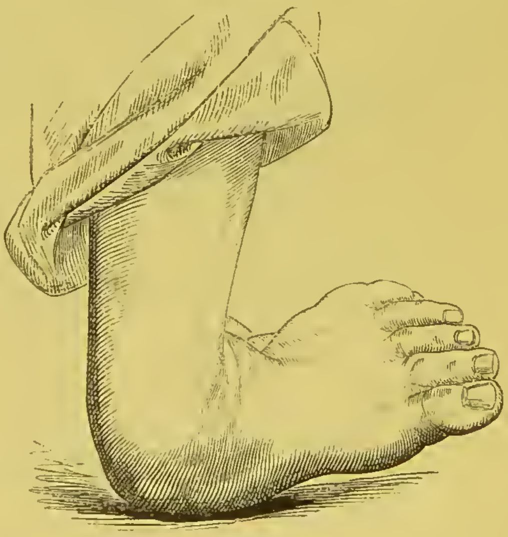
Marischal College, whose case was one of the fourth grade of talipes varus, who walked on the dorsum of the foot, but who, after having had the tendons of the posterior and anterior tibial muscles and the tendon of the flexor longus digitorum divided, by the use of Aveling's talivert, had, in four weeks, the varus removed; and on then dividing the tendo Achillis, and using the same apparatus, the equinus was obviated, and, before many weeks, the traces of the distortion were removed, and she walked gracefully with the sole properly directed to the ground.

TALIPES VALGUS.

This is much less common than either of the two former varieties of these deformities.

Symptoms.—Here, also, the foot undergoes a threefold alteration of its position in relation to the leg, but the alterations are the very reverse of those in talipes varus. The foot is flexed, abducted, and rotated outwards. Walking is very fatiguing, and in the worst cases, the patient can place no part of the sole of the foot on the ground, but treads upon the inner ankle; the knee of the affected side inclines inwards, and the limb presents the same appearance of atrophy as in the deformities already described. This variety also may be either congenital, or acquired.

Fig. 172.



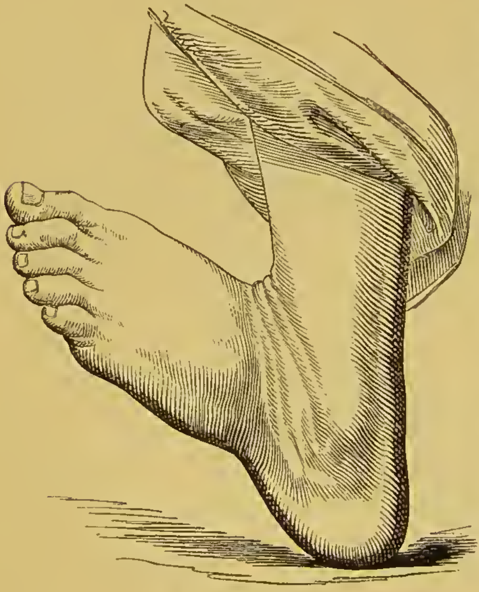
Varieties and Muscles affected.—Three grades of this distortion have been observed. In the first, which is rare, the foot is everted and rotated outwards, the peronei muscles alone being retracted. In the second, the most usual form of congenital valgus, the three peronei, the gastrocnemii, and extensor longus digitorum are retracted. In the third, the above-mentioned muscles, the tibialis anticus, extensor proprius pollicis, and abductor minimi digiti are retracted.

Treatment.—In the slightest grade, division of the peronei tendons, and afterwards mechanical extension, soon lead to the desired result. In the other grades, the proper proceeding is to reduce the distortion first to simple equinus, and then institute the treatment already described for the cure of that deformity.

TALIPES CALCANEUS.

This appellation was given by Dr. Little to a deformity which he met with in a child four and a half years of age, in whom the fore-part of the foot was elevated to the greatest possible extent, and the heel so much depressed as to have the long axis of the calcaneum in a line with the leg, and its posterior surface only touching the ground. The tendons on the front of the leg were tense, and those on the back relaxed; so much so, indeed, that the tendo Achillis could scarcely be felt. The foot was easily brought into its proper position, which proved that there was no structural shortening; and the treatment, which was successful, consisted in the use of a boot for maintaining the foot in its proper position. Of all distortions, this is the least important, the easiest of reduction, and that in which there is the least difficulty in maintaining the foot in its normal position. The distortion varies from the slightest drawing up of the foot to that grade in which the dorsum of the foot and the front of the leg are parallel with each other. The muscles which cause the distortion are the four muscles whose tendons are placed between the two malleoli in front—namely, the tibialis anticus, extensor proprius pollicis, extensor longus deplorum, and peroneus tertius. The posterior portions of the lateral ligaments are greatly elongated.

Fig. 173.



From Dr. Little.

Slighter grades of this deformity do not require tenotomy; the higher are treated by dividing the above-mentioned tendons and mechanical extension.

Having mentioned the symptoms, abnormal conditions, and treatment of these deformities, it may be satisfactory to state very shortly the views now entertained regarding their origin, and the history of treatment now so generally and successfully adopted. The opinion now generally entertained is, that these affections are caused by a disturbance in the equilibrium of antagonizing sets of muscles. The writings of Duvernay, Töng, Boyer, Rudolphi, Shaw, Delpech, Stromeyer, Guérin, Duval, and some others, have been the means of gradually leading to the adoption of this view, to its fuller development, and more lately to its perfect confirmation, together with its practical application in the treatment of these affections. Rudolphi appears to have held this view more clearly than his predecessors; he contended that congenital talipes proceeds from disordered influence of nerves on muscles during the period of fœtal existence. Delpech at one time believed that talipes originated in malformation of the tarsal bones; but even then he considered that the muscles contributed to increase the deformity; but he stated in his treatise "L'Orthomorphie," published in 1829, that he had renounced his opinion as to the origin of the deformity, and that he believed its immediate cause to be a disturbance of the natural and necessary equilibrium of the muscles, which disturbance may have resulted from remote influences, as effusion upon the brain or spinal cord, or from hydrocephalus, or from irritation excited in some part of the nervous system, or from direct injury of the nerves leading to muscles: as for example, in a case in which the external popliteal nerve was injured, and the injury was followed by paralysis of the tibialis anticus, extensor proprius pollicis, extensor longus digitorum, and peronei muscles, and by contraction of their antagonists, and consequent distortion of the foot; or in a case in which talipes varus, in an extreme degree, followed injury of the nerves, induced by necrosis and abscess of the femur. Delpech, however, was of opinion that the gastrocnemii are the only muscles involved in the production of talipes varus, and that the adduction of the foot is caused by pressure in walking. Stromeyer believes the contraction of the gastrocnemii to be the essential cause of talipes equinus and talipes varus, and the deficiency of the internal malleolus the cause of the inclination inwards in talipes varus. He supposes that if the contraction of the gastrocnemii occur during the early months of fœtal life, talipes varus will be the result; whereas, if it take place at a later period, after the malleolus internus is in a measure developed, the deformity will be talipes equinus, with or without slight inclination of the foot; in short, he regards contraction of the gastrocnemii as the essential cause, and all varieties as secondary phenomena; whereas the opinion now generally entertained is that which the observations of Guérin, Duval, and Little have established, namely, that the deformity, when superadded to retraction of the heel, is to be referred to the action of other muscles affected similarly with those which occasion the retraction of the heel. Dr. Little has given such a clear exposition of his views in the following sentences, that I cannot forbear transcribing them:—

"Let us now fully consider those congenital contractions of the feet which depend on derangement of the nervous and muscular systems, and ascertain in what way a permanent deformity arises. In the first place, we will take a case originating from paralysis of the anterior tibial muscle. Here the remote injury, the cause of paralysis, is the same as that of paralysis of other parts of the body, namely, inflammation and the effusion of blood, or sero-sanguineous or serous fluid, in some part of the brain or spinal cord, which compresses or otherwise injures the delicate texture of that part of the nervous centre whence the affected muscles derive their nerves. The *posterior* muscles of the leg (those of the calf in particular) having lost their natural antagonists, become firmly and permanently contracted, by the constant action of their involuntary contractile power, by which the heel is raised from the ground, Talipes equinus. At an early period of the disease, this contraction may be overcome by forcibly bending the foot with the hand: but this, after a time, becomes impossible. The other case, that of a Talipes originating from spasm, admits of a different explanation. The remote cause resides either in the central organs of the nervous system (most probably in the spinal marrow), or it is a disease existing in some other organ of the body, affecting peripheral parts of the nervous system; for instance, in some one of the viscera of the chest or abdomen, more probably of the latter. From this an injury is propagated to the central organ, and is reflected to certain muscles of the leg, which become spasmodically contracted. In other words, there may be either some deviation from the healthy state in a part of the spinal marrow, where the roots of the motor nerves distributed to the muscles of the calf are implicated or irritated, causing them to become involuntarily contracted; or there may exist elsewhere some disease, such as irritation of the mucous membrane of the alimentary canal by improper or undigested food, or worms, through which filaments of nerves (named by Dr. Hall *incident*) are excited. These communicate in the spinal cord with other filaments—the *reflex*, or involuntary motor nerves, whereby the muscles of the calf are excited to spasmodic action. In this explanation of the production of non-congenital Talipes I have confined myself to the most simple and intelligible form of Talipes equinus. The Talipes varus differs only in depending on paralysis or spasm of a larger number of muscles. When paralysis is the cause, the peronei muscles have lost their power, as well as the anterior tibial, and long extensor muscles of the toes. If spasmodic contraction be the cause, the posterior tibial muscle, long flexor muscle of the great toe, those of the sole of the foot, and sometimes the tibialis anticus muscle, are partially involved in the production of the deformity. I have here defined the manner in which I consider Talipes to arise after birth. Any cause, whether paralysis or spasmodic, by which the equilibrium, between different sets of muscles that are naturally antagonists, is disturbed, produces the distortion vulgarly called club-foot. Other causes, namely, those which produce a shortening of the muscles and other soft parts upon one side of the leg by disturbing (although in a different manner) the antagonism of the muscles, are capable of producing deformities similar to those belonging to the genus Talipes.

"Having thus offered my opinion of the causes of those deformities of the feet which take place after birth, and stated the identity of their symptoms and morbid anatomy, with those of the club-foot with which children are born, the probability will, I think, appear obvious that the remote causes are the same; but there are other phenomena connected with the history of these affections, which render the accuracy of these opinions almost capable of demonstration. Fœtuses which have suffered some evident derangement in the development of the nervous system, such as those denominated hemicephalous and acephalous, or affected with spina bifida, and those born before the expiration of the natural period of utero-gestation, are particularly obnoxious to this deformity of the feet. The occurrence of the perfectly analogous deformity of the hands, which takes place prior to birth, denominated club-hand, in which the flexors and pronators (analogous to the so-called extensors and adductors of the foot,) are likewise contracted, corroborates the opinion that congenital club-foot depends on spasmodic muscular contraction. In the instances which I have examined of congenital deformity of the hand (club-hand), both in museums and in the living subject, the feet were also affected with Talipes, proving the operation of a common cause. Other circumstances corroborative of this opinion are, the co-existence with congenital club-foot of congenital squinting, and even congenital stammering or mis-enunciation, diseases which evidently depend either on increase of the involuntary, or the decrease of the voluntary motor powers of the orbital and laryngeal muscles. The importance of these facts is increased by the observation I have made, that non-congenital club-foot is likewise occasionally accompanied by strabismus."

The instances are extremely rare in which congenital Talipes is caused by paralysis.

From the time of Hippocrates until March, 1784, the treatment of Talipes consisted in the employment of mechanical pressure, and the varieties were merely different contrivances and appliances for facilitating the adoption of the same principles of treatment; but in 1784, the first step was taken towards the present method, a physician of the name of Thilenius having suggested the division of the tendons affected with shortening; and his suggestion was carried into practice by Lorenz, a surgeon at Frankfort, in the case of a young lady affected from infancy with Talipes varus. The heel descended two inches after the operation, and the lady was able to walk on the entire sole. It was the tendo Achillis that was divided, and the operation was performed under the direction of Thilenius. The division, however, was effected by a large wound. The suggestion of Thilenius was also carried into practice at a subsequent period by Sartorius, whose method of operating, however, was liable to many objections, particularly because he made extensive incisions of the superimposed parts, exposed the tendon at the part to be divided, and after section of the tendon, immediately attempted to bring the foot to its proper position. The consequences were unfavourable, and such as do not follow the operation of section of the tendons as it is practised at the present day. Michälis suggested a different method of treatment, which consisted in a partial division of the shortened tendon, and bringing the foot to its proper position immediately after the operation. He recommended section of the tendon to the extent of one-third of its thickness, by which means its strength would be materially diminished. His first operation he performed in November, 1809. Both Sartorius and Michälis recommended immediate restoration of the foot to its proper position, the one after complete, the other after partial division of the tendon; but neither of their methods of treatment met with general adoption or approval.

Delpech had the merit of conceiving and recommending some new and important principles of treatment. Having observed that after rupture of the tendo Achillis and some other injuries, the uniting medium admits of considerable elongation, it occurred to him that the same elongation could be obtained after section of the tendo Achillis for the cure of Talipes, provided mechanical extension be employed before the uniting medium has acquired great strength and firmness. He recommended that the section of the tendon should be effected without division of the common integument over it: and in the instance in which he performed the operation, he made a wound of the common integument an inch in length on each side of the tendo Achillis by passing a scalpel between it and the deeper-seated structures; and then by a convex-edged bistoury, he divided the tendon from before backwards. He recommended that, after the operation, the cut portions should be preserved in apposition, by maintaining the foot in the distorted position by mechanism, until reunion of the divided tendon be effected—that careful and gradual extension of the uniting medium should then be made, until the tendon be of sufficient length; and this having been obtained, that the limb be kept in a proper position by means of apparatus until the new substance has acquired sufficient strength. Delpech performed his operation in May, 1816, and although a cure was effected after a long period, and the patient ultimately recovered, yet there were so many discouraging circumstances, that he never repeated his operation. Although the mode of dividing the tendon recommended by Delpech is exceedingly objectionable, he certainly has the merit of having suggested some important principles in the after treatment. To Stromeyer, who performed his first operation in February, 1831, the praise belongs of having perceived what was objectionable, and appreciated what was valuable, in the views of those who preceded him, and of proposing the safe and successful operation, with the mode of after treatment, which is now so generally approved of, and so successfully adopted.

CHAPTER XV.

DISEASES OF THE ARTERIES.

ARTERITIS.

Arteritis may be in activity, acute or chronic; and in extent, general, invading a large portion of the arterial system, or partial, confined to the trunks and branches of a particular part.

Symptoms and Morbid Appearances.—The symptoms vary according to the intensity of the attack, the stage of the disease, and the changes occasioned by the inflammation in the affected vessels. While the disease is still slight, and no such changes have occurred in the coats or contents of the vessels as to obstruct their canals, the principal symptom is pain along the track of the vessels, which pain is increased by pressure, motion, or extension of the affected part. On laying the finger over the course of the vessel, the pulsation is felt to be weak, and to convey a tremulous sensation. When the Arteritis is more severe, and gives rise to changes which will presently be described, the pain and tenderness are much increased, an incompressible hardness is felt in the situation of the principal arterial trunks affected, and the pulsation, at first presenting the peculiarity above mentioned, by and by ceases entirely. Together with these symptoms in the tracks of the main trunks, there will also be pain in the limb, accompanied with a purplish red appearance, and œdematous swelling; and if the collateral branches be affected, the part will exhibit the usual symptoms of gangrene. If the arteritis be but to a slight extent, there may be little or no constitutional disturbance; but when it is intense, so as materially to impede the functions of the trunks and collateral vessels, there will, in addition to the local symptoms, be those of irritative fever. Some years ago I met with a striking example of acute idiopathic Arteritis in a female, about thirty years of age. I was called to see her in consequence of severe pain in the fore-arm and lower part of the arm, which commenced very suddenly some hours before I saw her. At first the pain was chiefly along the course of the radial and ulnar arteries, the pulsation of which vessels was feeble, and that of the humeral artery was labouring. The pain soon became diffused over the under part of the arm, the fore-arm, and hand, and was of a bursting character, with œdematous swelling, and a purplish discoloration of all parts below the commencement of the lower fifth of the arm. In the course of eight hours from the beginning of the attack, the pulsation of the radial and ulnar arteries, and of the humeral artery in the two lower thirds of the arm entirely ceased, and the parts exhibited the ordinary appearance of what is now usually denominated spontaneous gangrene. The line of demarcation soon presented itself at the commencement of the lower fifth of the arm. After some days, it was deemed advisable by an experienced surgeon and myself, to perform amputation about the middle of the arm. This was done, and the patient recovered, and continued perfectly well for two years, when she left Aberdeen with the intention of residing with her relations in a distant part of the country. The day after her journey she was seized with symptoms in both her lower extremities, similar to those which she had previously had in her arm, and in the course of twenty-four hours nearly the whole of both lower extremities presented the characters of gangrene, and the patient died some hours afterwards. This case furnishes a striking example of the serious consequences which sometimes result from Arteritis; and in the latter part of its history, a remarkable instance of the truth of the observation made by M. Bizot, as to the symmetrical occurrence of arterial disease. In the case already referred to, I found, on a careful dissection of the arteries, that their coats presented a red inflamed appearance, as though some irritating fluid had been injected into them; they seemed to be softer and thicker than natural; the canals, which seemed large, were filled with coagulated blood, and at many points there was a slight lamella of lymph on the internal membrane. No adhesions were perceptible between the coagulum and lymph; but in some examples of this form of Arteritis adhesions have been observed. That the coagulum was formed at an early period is certain, from the cessation of the pulsation. Such were the symptoms and morbid appearances in a well-marked example of what may be termed acute idiopathic fibrinous arteritis. Dupuytren was the first who ascribed the so-called spontaneous gangrene to Arteritis. The same view was supported by Cruveilhier, who from observations on the human body, and from numerous experiments in which he excited Arteritis in the lower animals, by injecting irritating fluids into the arteries of their extremities, came to the conclusion that the essential character of inflammation of an artery is coagulation of the blood within it, and that gangrene is the result of occlusion, not only of the trunks, but also of the collateral branches. The distinguishing peculiarities of gangrene caused by arteritis are mentioned in the description of the various forms of gangrene in the first chapter of this work.

Treatment.—This form of arteritis should be treated on the same general principles as inflammation of other parts. Perfect tranquillity of body and mind should be strictly enjoined, as any exertion or emotion, which would accelerate the circulation, would, by increasing the distension of the vessels, aggravate the disease. The prompt but judicious exhibition of mercury, unless an irritable, shattered, or scrofulous constitution should forbid its employment, is calculated to be highly beneficial by checking inflammation and diminishing fibrinous effusion. In the way of local remedies at an early stage, perfect rest of the affected part, depletion by leeches, attention to attitude, and the use of warm and emollient applications are very important.

ACUTE SUPPURATIVE ARTERITIS.

In individuals of shattered, or weak, or cachectic constitutions, a very dangerous form of acute arteritis sometimes, though very rarely, takes place, and gives rise to phenomena, which in many respects resemble those consequent on diffuse suppurative phlebitis. It is much more rare than the latter affection, in consequence of the structures which enter into the formation of an artery being less susceptible of inflammation in any of its forms than those which form the coats of veins. The inflammation has a tendency to spread from the part first affected. It is extremely acute, and is believed to cause the formation of purulent matter at an early period. This by being mixed with the blood in its circulation, is thought to give rise to the peculiarity of the constitutional symptoms, which often prove speedily fatal before gangrene has taken place. Violent irritative fever attends the very commencement of this disease; and it very speedily assumes the worst form of atonic or typhoid fever. Some of the most remarkable features attending its progress are, extreme prostration of the vital powers; a weak, quick, and small pulse; a pallid and shrunk countenance, expressive of suffering; a dull, lurid, dirty-looking hue of the surface of the body; a morbid state of all the secretions; flaccidity of the soft solids; a dry and encrusted tongue; low delirium; and other symptoms indicative of extreme depression of the vital powers. As there is no fibrinous effusion, and in the extremely depressed state of the vital powers, little or no tendency to coagulation of the blood, there is direct purulent admixture with the blood, in consequence of the circulation through the inflamed part not being interrupted. The principal peculiarities of this form of arteritis are, its tendency to become diffuse, to go on to suppuration, and if the patient survive any length of time, to terminate in gangrene as its most usual local result, and the very early change of the acute irritative fever to one of the typhoid type. The lesions occasioned by acute suppurative arteritis consist chiefly of a dark red, or purple-coloured injection of the walls of the vessel, seen on examining its interior, softening of its more internal textures, and sanious infiltration into them in various situations.

Treatment.—However needful it may be at first to use means which produce a relaxing effect upon the capillary vessels, promote secretion, soothe nervous irritation, equalize the circulation, and facilitate the excretory actions, still when the accompanying fever assumes the typhoid type, those adapted to the state of depression and exhaustion, and calculated to support the vital powers, should be actively administered, however little hope there may be of averting an unfavourable result.

LIMITED ARTERITIS AND RESULTS OF LIGATURE.

This form of arteritis almost always arises from causes which are external and local in their operation, as a wound, or the application of a ligature; and it assumes the sthenic character and usually gives rise to changes which result from that form of inflammation. The local results are various, being regulated to a considerable extent by the manner in which the injury is inflicted, and the amount of inflammatory action induced. On this subject, Miller says, "The minor grades will give exudation of a plastic kind, such as we desiderate after deligation; the coats become turgid and coherent; and the canal is completely obliterated at the part affected. A higher grade of action, reaching the truly inflammatory, gives suppuration, usually conjoined with ulceration; a result which we do not desiderate, but, on the contrary, take every means to avoid, in operations on the larger vessels; hemorrhage being almost certain to follow. A still higher action, more especially if combined with circumstances tending to impair vital power of the tissue, causes gangrene of the vessel, a still more disastrous event; exemplified by the deligation of an artery whose coats have been too rudely manipulated, and too extensively separated from their cellular connexions."

Much insight into the nature and results of adhesive inflammation, by which arteries are obliterated, has been obtained by observing the results of that process on the coats and contents of an artery at different periods after the application of a ligature. Two most attentive observers of that process were Jones, who investigated it through its different stages, and Stilling, who mentions seventy experiments on animals,—experiments which were judiciously conceived and carefully performed, and by their results, as well as by those of Jones's investigations, many important facts have been ascertained. According to Stilling, of whose researches those of others, so far as they go, are confirmative, some of the most important changes after the deligation of an artery are the following. On tying an artery tightly with a small ligature, its two inner coats are cut through, and the canal of the artery is closed by the apposition of the opposite sides of the outer coat, and immediately after deligation, stagnation ensues to the next collateral branches, with accumulation of blood-globules near the ligature, followed by coagulation of fibrin from the fluid constituents of the blood. The coagulum is, during the first eighteen hours, of the form of a cone, with its apex towards the heart, attached only by its base to the part where the ligature is applied; of very slight cohesion, and not of uniform colour throughout, being red towards its base, and of a yellowish colour like that of inflammatory crust towards its apex. It next undergoes a change of form, of firmness, and of colour; its form becomes more spindle-shaped, the end nearest to the ligature tapering less than the other; its firmness increases partly in consequence of stronger coagulation, and partly from effusion from the parietes of the artery; and its colour becomes an almost uniform pink or red. It by and by becomes attached to the parietes of the artery, the attachment being produced by exudation from the vessel, and the adhesions present a filamentous appearance when the plug is detached from the interior of the artery. Stilling and Hassie both state that when there has been much exudation, the plug exhibits externally several concentric layers. Exudation of lymph takes place into the cellular tissue surrounding the artery; its different coats can no longer be distinguished, and sooner or later, by means of the thin exudation of lymph exterior to the portion of coagulum formed by the coagulation of the blood, the walls of the artery and the surrounding cellular tissue become condensed into one mass, in which the original parts can no longer be distinguished. Plastic exudation takes place from the extremities of the middle and inner coat divided at the line of deligation, and the dead portion of outer coat, embraced by the noose of the ligature, becomes detached from the living texture, and comes away with and allows of the removal of the ligature. The condensed mass formed of the exudation from the coats of the artery on the exterior of the coagulum, the walls of the artery, and the infiltrated cellular tissue, are proved by injection to be highly vascular; and that the vessels extend into the coagulum, is demonstrated by the vivid colour communicated to the latter in successful injections,—the appearance being such as, in the opinion of Stilling, to leave no doubt whatever of its being produced by vessels, and not by extravasation. The coagulum at this stage is traversed with innumerable canals, which give it a porous appearance, and ultimately it is entirely removed, so that the sides of the artery finally cohere. The cohesion is not only where the coagulum at one time existed, but it extends also a little nearer to the heart. The artery is thus ultimately obliterated. Some observers, in describing the different exudations, name the exudation into the surrounding cellular tissue and around the artery, the external coagulum; that from the extremities of the divided coats, the middle coagulum; and that within, the internal coagulum. Still more recently, Spence has performed a series of experiments, and has shown clearly the essential importance of the external exudation, and "that the internal clot, so far from being, as was supposed by Manee and others, essential to the separation of the ligature without hemorrhage, is not unfrequently wanting, when the vessel has been successfully tied; the closure being entirely effected in those cases by the plastic exudation between the cut edges of the internal coats, and by the bulky fibrinous mass which forms within and around the sheath. It is this external exudation which, becoming vascularized, forms the medium whence blood is supplied from all the surrounding parts to the important new formations within the external coat of the occluded vessel; and which, by its equable pressure upon the divided ends of the internal coats, prevents the tender adhesions within the sheath from being broken up, even when there is no coagulation. And hence arises an important practical caution; that it is not only advisable, in ligaturing an artery, to avoid unnecessary separation of the vessel from its sheath, but also that every undue interference with the soft parts around is also greatly to be deprecated. After a long time, vessels begin to pass even into the clot, when this is present; these vessels being always in connexion with those of the sheath and external lymph." These provisional structures having accomplished the purposes for which they were intended, are eventually removed. The surrounding textures assume their normal condition, all traces of swelling from deposition of lymph are removed, and the vessels become contracted to a mere thread from the first collateral branch above to that below the point of deligation.

CARTILAGINOUS DEGENERATION.

Cartilaginous patches occur most frequently before or about the middle period of life, and chiefly in the smaller arteries at a considerable distance from the heart; occasionally they are found in the larger arteries, and in such instances they occur at the points where branches originate. These deposits present considerable varieties as to transparency, consistence, and connexion with the inner membrane; sometimes they are transparent, of a semi-fluid consistence, and separable, so that they can be peeled off, leaving the internal membrane entire; sometimes they are less transparent, of the consistence of boiled white of egg, and can scarcely be peeled off without removing that coat; in other instances, they are opaque, of the appearance of cartilage, with the lining-membrane no longer discernible, and on the removal of the deposit, the middle coat is brought into view. These varieties are regarded as the different degrees of the same affection, which commences with albuminous effusion, the effusion gradually becoming more opaque and firmer in consistency, and more completely involving the internal arterial membrane. The only change these patches seem to undergo after assuming a cartilaginous consistency, is increase of thickness. The internal membrane, probably from having lost its elasticity, sometimes cracks around these bodies, which consequently hang into the artery, and in such circumstances, fibrinous coagula are apt to be deposited round their margins. Hassie states that he has twice found this condition in the abdominal aorta. I have, in my own collection, a beautiful preparation of the aorta, which strikingly exhibits this lesion. The opinions which at one time prevailed, that these cartilaginous patches originate between the internal and middle membranes, and that they are occasionally converted into osseous substances—that, in short, they form a preparatory stage to ossification, are now believed to be erroneous. These opinions, no doubt, arose from the occasional occurrence of cartilaginous degeneration of the internal membrane, co-existing with osseous formations between the inner and middle coats; but the latter differ remarkably from the former in their origin, mode of development, and the consequences to which they give rise, as will afterwards be stated. As to the nature of the morbid process, by which cartilaginous degeneration of the internal membrane is produced, pathologists are not agreed. Hassie thinks they are deposited immediately from the blood circulating through the vessel. Bizot, who examined the arterial system in one hundred and fifty-two subjects, and minutely investigated its morbid conditions, gives a clear description of the anatomical characters of this comparatively rare degeneration of the internal coat, and regards it as a product of inflammation of that coat. It may be said to have been proved by Bizot, who traced the transformation step by step, that the patches originate in the albuminous exudation of arteritis, which exudation is at first of a viscid gelatinous consistence, but gradually becomes firmer, and eventually supplants the inner membrane, on the free surface of which it was originally effused.

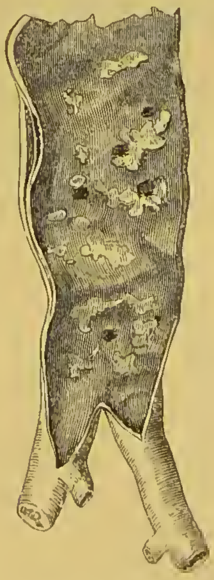
FATTY DEGENERATION.

The fatty degeneration was long overlooked, and seems to have been first noticed by Monro and Haller; but since they drew attention to it, it has been investigated with great success, and its anatomical characters and progress distinctly pointed out. Fatty degeneration commences by minute granules, of a pale-yellowish colour, situated between the internal and middle coats. While the disease is in this rudimentary state, the lining membrane is scarcely elevated at all; it is transparent, so that the spots are seen through it; it is unchanged in consistence; and if it be peeled off, the granules being adherent to its surface, come along with it. These granules coalesce into groups or masses in the next grade of the degeneration, and the inner membrane, though unchanged as to transparency or texture, is scarcely so flat as during the early stage; and if it be peeled off, part of the deposit comes away with it, and part clings to the middle coat, from which it appears obvious, that the unnatural deposit is developed between them. The middle coat, at the seat of the deposit, is of a light yellow colour, and of a more friable texture than natural, but neither in it, nor in the surrounding textures, are traces of inflammatory action discoverable. The deposit has the consistence of suet—feels greasy to the touch—is of an opaque appearance, and when broken down by the finger, gives the sensation of minute granules scattered through a fatty substance. Not only has it a fatty appearance, but the researches of Gulliver show, that its chemical composition also differs but little from that of ordinary fat. Bizot detected shining particles in this deposit; Cruveilhier, small masses resembling crystals of cholesterine; Gluge, on examining these masses with the microscope, found them to consist of fat globules; and Sivaine, who also repeatedly examined them with the microscope, states that he "found them, on several occasions, to consist of fat globules merely; generally, however, they were made up of an amorphous granular mass, mingled partly with fat drops, partly with numerous crystals of cholesterine. The shining particles are often very numerous, some having a golden, and some a silvery hue."

This form of the degeneration is now well known to consist of a quantity of fat globules, plates of cholesterine, and amorphous masses; the latter consist of earthy salts, as carbonate and phosphate of lime; hence the effervescence when an acid is added to them. A variety of the fatty deposit has been described by Scarpa, Stentzel, and many others, in which the secretion is of a yellowish colour, and of a cheesy or wax-like consistency. It commences most frequently in the bifurcations of arteries, and originates between the middle and inner coats; but it differs from the deposit already described, in being of firmer consistence, and in rarely containing gritty calcareous deposition. To this variety some restrict the term steatomatous, and give to that already described the name of atheromatous degeneration.

The fatty degeneration, after attaining the grade last described, may undergo one or other of various transformations. The two principal are, softening and osseous transformation. For the sake of clearer description, the various changes in softening have been arranged into three stages. The first is characterized by the absence of any change in colour, transparency, or consistency of the internal membrane. This membrane, however, is slightly elevated, there being more of the deposit than in the former grades of the disease; and the middle coat is still more altered and softened, and of a still brighter yellow colour at the affected spot. In the second stage, the patches are distinctly elevated, like pustules, and when pressed with the finger, produce the impression of their containing a semifluid substance. In the third stage, the internal membrane having cracked or disappeared, allows an escape of the deposit, and the sanguineous current comes into contact with the walls formed of the outer coat, or of that and the yellowish detritus of some very small portion of the middle coat. This softening or liquefaction of the deposit is well known to depend

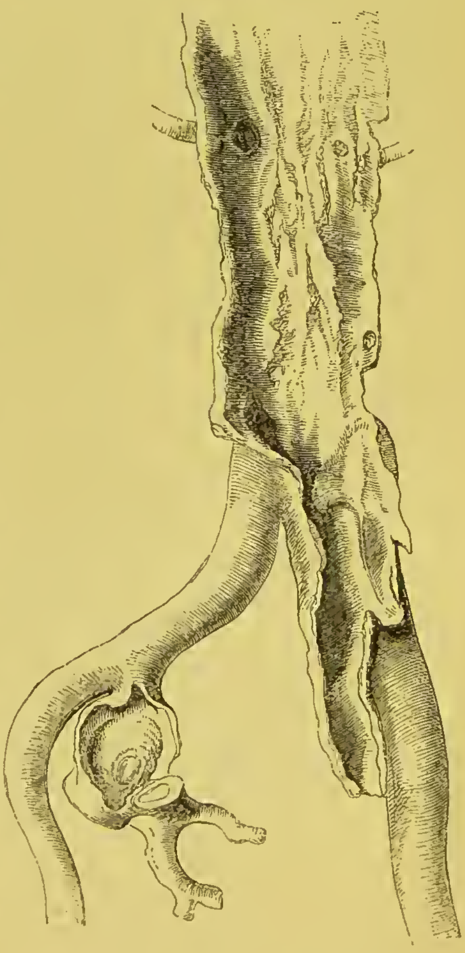
Fig. 174.



From a preparation in my museum.

on the abundant formation of fat globules and scales of cholesterine. While this destructive action is going on in the middle and internal coats, a conservative process is set up in the external coat. This coat becomes greatly thickened and strengthened by the deposition of plastic matter, and the coats come firmly to adhere to each other around the circumference of the degeneration. The former provision diminishes the danger of rupture, and the latter opposes an obstacle to the blood passing in between the coats after the deposit has been washed away by the circulating current. Such are the characters of the fatty degeneration, when it undergoes the softening transformation; but, as has been stated above, it may undergo an opposite change, termed the osseous transformation. The term transformation has been objected to, when applied to this last-mentioned change, as the calcareous matter is merely deposited in the yellow fatty substance, which is regarded by many as forming its nidus. The calcareous matter assumes the form of thin, brittle scales or plates, of a yellowish-white colour, surrounded at first by fatty deposit, but not having any fibres or organized structures between them. They are believed to increase very slowly, the surface directed to the lining membrane more slowly than that directed outwards; and they evidently enlarge more in extent than in thickness. As the calcareous deposit increases, it comes into contact with the lining membrane, which in many cases at length gives way, so that the blood is in immediate contact with the calcareous deposit; and the middle coat, after having been attenuated and changed as already described, ultimately disappears, and its place may be said to be occupied by the concretion; hence has arisen the erroneous opinion that this coat itself is transformed into bone. The calcareous concretions are found in various forms; they usually consist of plates or scales, varying considerably in extent, and, in some

Fig. 175.



From a preparation in my museum.

rare instances, occupying the whole circumference of the vessel at the affected part, so as to convert it into an inflexible tube. Sometimes they consist of minute grains; and more rarely, they give, on examination with the finger, the sensation of a number of minute bodies, moveable on each other, as if jointed together. As cartilaginous degeneration of the inner coat is not very unfrequently found coexisting with the form of calcareous transformation just described, the error of ascribing the calcareous deposit to ossification of the previously-existing cartilage is easily accounted for. Such are the anatomical characters of the softening and calcareous transformations of fatty degeneration. Sometimes when the fatty deposit exists in great quantity, it diminishes the channel of the artery; but it is much more frequently productive of dilatation with or without rupture, or of circumscribed or diffuse false aneurism—dilatation being more frequently the result of the fatty deposit, and rupture, with its consequences, of that condition when accompanied by calcareous concretion.

The fatty and calcareous degenerations are not now considered results of the inflammatory process, but as instances in the vascular system of retrograde metamorphoses of which so many examples are met with in other textures, and of which the cause is believed to be defect of the nutritive process. Diminution of healthy nutritive activity in some parts gives rise to atrophy of tissue, and in other textures to transmutation into a structure still lower in the scale of organization. Complete fatty degeneration in all its stages is regarded as a transformation of coats of the vessel into minute oil drops and granular bodies; these bodies, in consequence of defective nutrition, taking the place of the natural elements of the tissue. The chief diversity of opinion on this point is as to the principal or first seat of the deposit. Paget believes that it is "in the more or less developed muscular or transversely fibrous coat," whereas the more generally received opinion is, that it first takes place on the outer layer of the inner coat corresponding to the fenestrated coat of Henle, and between the internal and middle coat, the inner aspect of which is very early involved. When the fatty degeneration undergoes the osseous transformation constituting the laminar calcification of some authors, the patches are situated principally in the longitudinal fibrous coat, and are chiefly met with where that structure abounds, as in the arch of the aorta, in the carotids, and the bifurcation of the iliac arteries.

CALCAREOUS DEGENERATION.

Calcareous degeneration has been referred to by authors under the various names of ossification, calcification, earthy degeneration, calcareous deposit, and osseous transformation. One variety of this disease, namely, that which is often found to occur as a transformation in the progress of fatty degeneration, has already been described; but there is another form, differing from this in many important particulars. Its seat is in the transverse fibres of the middle coat itself; it appears in the form of plates or spicula, occupying a greater or less extent of vessel; and in some examples, it at last becomes so extensive and complete as to convert the affected part of the artery into an inert tube, constituting the annular calcification of some authors, and the tubular, when in an increased degree. This degeneration seldom affects the whole circumference of an artery, except in the lower extremities, where it has been found to exist in distinct rings. The middle coat loses its equable aspect, some of its fibres shrivel, and the coat consequently becomes thin. It is yellower than natural, and instead of being elastic, becomes friable and easily torn. If at this period, the vessel be cut in the direction of its length, the margins of the incision appear irregular, from the change not having been uniform, some fibres having lost more of their elasticity than others. Such are the early deviations from the healthy appearance of the middle coat, the fibres of which are ultimately changed into, and their place occupied by, an osseous formation. In consequence of this change, the external surface of the artery, in many instances, presents an uneven appearance, becoming unequally dilated in some parts, and slightly constricted in others. The internal coat, while the disease is limited and of recent standing, may remain entire, though shrivelled and irregular; but in an advanced stage, the inner surface of the vessel often becomes ragged and irregular—a result of the rupture of the internal membrane at the margins of the calcareous deposit. The morbid change now under consideration is most frequently found in the arteries of the lower extremities, in the coronary arteries, and in the arteries of the brain; and the fatty degeneration most frequently in the aorta. Dilatation and aneurism are more rarely caused by the calcareous than by the fatty degeneration. In individuals at an advanced period of life, the calcareous degeneration not unfrequently produces in the lower extremities gangrene of feet and limbs, and in the vessels of the brain rupture, ending in fatal extravasation of blood and compression of the brain. Softening of the brain is a well-known consequence of both the fatty and the calcareous degeneration of vessels of that organ, and fatty heart is frequently caused by ossification of the coronary arteries; these conditions being results of defective nutrition. Another consequence of this degeneration is hemorrhage after the deligation of an artery; the vessel cracks at the part where the ligature is applied, adhesion does not follow, and ulceration and hemorrhage result. The fatty degeneration and its various sequelæ are occasionally coexistent with the calcareous. Calcareous deposition differs from bone in essential particulars; it is destitute of fibrous structure and of vascularity; it presents an irregular crystalline and granular appearance; it consists, according to Lassaigne, of phosphate and carbonate of lime, and of animal matter; and it is destitute of any obvious arrangement. The period of life at which calcareous degeneration most frequently occurs, is after the sixtieth year; but it may take place at a much earlier period under the influence of causes which impair the vital forces: and no doubt it is in this way that certain diseases, such as gout, phthisis, and granular disease of the kidneys, have a tendency to promote this degeneration of tissue. These earthy deposits in the arteries constitute but one of various examples of calcareous degeneration, so common in old age, displayed in the gradually increasing proportion of earthy matter in various parts.

ANEURISM.

By the term aneurism, derived from the Greek ἀνεύρισμα, signifying a dilatation, is meant a pulsating tumour containing blood, and communicating with the interior of an artery.

I. *Divisions.*—Various divisions have been made of aneurisms. Some writers, taking situation as the basis of arrangement, have divided them into internal, or inaccessible; and external, or accessible. By an external or accessible ancurism is meant an aneurism so situated, that it is possible to include the trunk of an affected artery in a ligature, between the aneurism and the heart; where this is impossible, the aneurism is termed internal, or inaccessible. To the latter class belong aneurisms in the cavities of the body, as in the abdomen, chest, and cranium. Another division is based on the manner in which the aneurism is formed, and the tissue constituting the aneurismal sac. According to this arrangement, which is both ancient and useful, all aneurisms may be arranged into two classes—true and false. Much confusion, however, has arisen from systematic writers attaching different meanings to these terms. By a true aneurism, some authors mean one in which the aneurismal sac is formed by some or all of the coats of an artery; and by a false aneurism, one in which some other tissue forms the aneurismal sac. We shall use the terms in this sense. Cruveilhier, from finding the imperfections of other classifications, and the difficulty of ascertaining beyond doubt the state of the arterial coats, by which alone could be formed a classification founded on a pathological basis, proposed an arrangement based entirely on outward form; namely, A. Aneurismes sous l'aspect d'ampoules; 1. Aneurismes Périphériques; 2. Aneurismes Sémipériphériques; 3. Aneurismes à Bosselures. B. Aneurismes sous l'aspect de Poches à Collets.

TRUE ANEURISMS.

II. *Mode of Formation.*—True aneurisms may be formed in various ways:—

1. *By Dilatation.*—It has been clearly proved by various dissec-

tions, in which the true arterial coats have been traced in unbroken continuity through the parietes of the sac, that aneurisms are sometimes formed without any rupture by dilatation of all the coats. This doctrine, advanced by Fernelius, Diemerbroek, Haller, and others, was called in question by Scarpa, who conceived that true aneurisms are always formed by destruction of some of the tunics of an artery—an opinion in which Bizot seems disposed to coincide. The opinion of Scarpa, however, was successfully combated by Hodgson, who by minutely examining numerous preparations in the different museums in London, by carefully dissecting many aneurisms in their different stages of formation, and by tracing the coats of the artery in unbroken continuity through the sac, ascertained that although in the majority of instances, especially when aneurisms have attained a considerable size, the coats of the vessel have given way, still many aneurisms are formed by dilatation, and that Scarpa therefore was on this point certainly in error. The dilatation may affect only a limited portion of the circumference of the artery, constituting what from its form is called a sacculated or sacciform aneurism; or it may implicate the whole circumference and affect the artery to a considerable extent longitudinally, constituting, when regular in its outline and abrupt at its extremities, a cylindrical aneurism; or it may commence and terminate gradually, in which case it is called a fusiform aneurism; or it may be very irregular, giving to the artery a knotty and tortuous appearance, constituting what Breschet has denominated the varicose form of true aneurism. The formation of aneurism by dilatation is often observed in the aorta.

2. *By Rupture.*—If an artery, affected with any of the forms of degeneration formerly described, be violently stretched, as in leaping, running, or by any violent exertion in walking, then the inner and middle coats may become lacerated, the diseased condition may prevent adhesion, and the result may be the dilatation and ultimately the giving way of the outer coat. The doctrine that aneurism was formed by rupture of the coats of an artery was maintained by Sennertus, Hildanus, Severinus, and others. It is usually called, however, the doctrine of Sennertus, and has been ably supported by Scarpa, who contended that aneurism is formed "by a corrosion and rupture of the proper coats of the artery, and consequently by effusion of blood under the cellular sheath, or any other membrane which covers externally the injured artery." Aneurisms formed in this way are not unusual in the extremities, more especially at the flexures of the joints; and they are more frequent in men than in women, probably because they are more exposed to the exciting causes of their formation. In most instances, the rupture of the coats is attended with sharp pain, and many patients have stated, that they felt as if they had received a smart blow on the

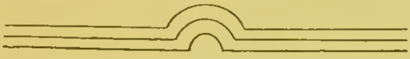
part, and have been able from this circumstance to date the commencement of the disease.

3. *By Dilatation and Rupture.*—Cases recorded by Lancisi, Friend, Guattani, Morgagni, Monro, and many subsequent observers, leave no doubt that aneurism may arise from dilatation and rupture conjointly; and in the opinion of many distinguished pathologists, this is the most frequent mode of its formation. There is first a dilatation of all the coats, forming a true aneurism; but when the expansion reaches a certain point, the inner and middle coats, having less power of extension than the outer, become ruptured or give way, and the outer coat becomes distended and forms a sac which surmounts the primary dilatation. The expansion of all the coats constitutes a true aneurism, which may be termed primary; the dilatation of the outer coat forms a consecutive aneurism. Such cases have been denominated compound or mixed aneurisms. The peculiarity of this mode of formation is, that rupture of the internal and middle coats takes place after their dilatation, and is followed by a still farther dilatation of the outer coat. Examples of this form of aneurism occur not unfrequently in the aorta. The above are the principal changes in the coats of arteries constituting aneurisms; and they may all be said to proceed from pre-existing changes connected with the fatty or calcareous degenerations, or with these conjointly; or the pre-existing change may, in some instances, consist only of a low grade of inflammation causing debility and defective vital cohesion of texture,—common results of inflammation in many other textures of the body. There can be no doubt, however, that the fatty degeneration is by far the most frequent predisposing cause of aneurism, and the rationale of its operation may be very easily understood from what was stated, in a former section, as to the conditions to which it gives rise. The elasticity and resiliency of the coats are diminished in proportion to the amount of the degeneration, and the artery becomes unable to contract on its contents, and to recover during the diastole the force of the systolic impulse, and gradually yields and becomes dilated under the repeated shocks of outward pressure of the blood. If the degeneration be confined to a particular part, and implicate only one side of an artery, it is easy to conceive how, on the destruction of the elasticity of the inner and middle coats, the column of blood acting with equal force on every side will give rise to a dilatation or pouch on one side, constituting a sacciform aneurism. If the degeneration extend around the whole circumference, and be abrupt at its commencement and termination, the distending force may cause a cylindrical aneurism; whereas, if the transition from the healthy to the diseased state be more gradual, a fusiform aneurism will more probably be the result. As has been already stated, any of the various degenerations of the coats, or a low grade of inflammation may constitute the pre-existing change which

predisposes to the formation of aneurism. The fatty degeneration is by far the most frequent, the true calcareous degeneration of old people comparatively rare. The latter, however, may lead to the formation of aneurism by causing rupture of the inner coats, or the narrowing of the arterial canal, which it occasions, may be followed by dilatation on its cardiac side, leading to the giving way of the inner and middle coats. The three modes of formation then are—by dilatation alone, by rupture alone, or by dilatation and rupture conjointly.

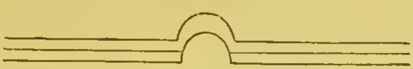
III. *Varieties.*—Besides the differences of form which have led to the appellations of sacciform, fusiform, cylindrical, and varicose, and the differences in the kind of degeneration which may constitute the pre-existing change, true aneurisms present numerous varieties in the condition of the several coats of the artery and their relation to the aneurismal sac. The principal varieties are the following, the first four of which are illustrated by Wardrop, by the accompanying diagrams :—

Fig. 176.



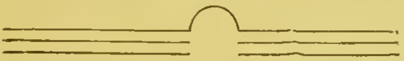
1st. The parietes of the aneurismal sac may be formed by the distension of the three coats.

Fig. 177.



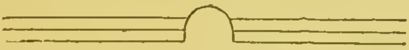
2nd. They may be formed by the dilatation of the internal and external coats, the middle coat having been ruptured.

Fig. 178.



3rd. They may be formed by the dilatation of the external coat, the middle and internal coats having been ruptured or destroyed by ulceration, or by rupture and ulceration.

Fig. 179.



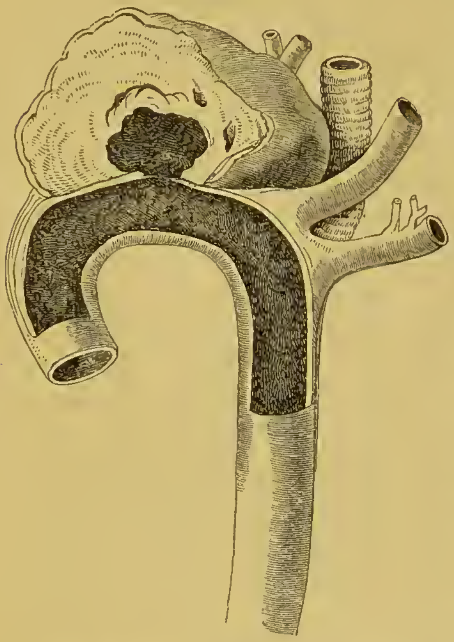
4th. They may be formed by the dilatation, or hernia, of the internal coat, the external and middle coats having given way.

This rare variety, examples of which have been observed by Haller, Dupuytren, Dubois, Breschet, Laennec, and Liston, has been hitherto regarded by most observers as peculiar to the aorta, the inner membrane of which is more loose and elastic than that of other parts of the arterial system ; but Breschet conceives that he has proved its occurrence in smaller arteries. It probably arises from the destruction of the external and middle coats by disease, and according to Laennec, the inner coat will protrude and form an aneurismal sac while the swelling is small, but will be apt to burst as the tumour becomes larger. Laennec refers to four examples, in two of which the aneurisms were of the size of cherries, and the inner membrane, though dilated, was entire; in the other two, they were of the size of walnuts, and the inner coat had given way. Laennec says—"The opinion at present current in the Parisian schools, viz., that in aneurism the internal coat remains entire, and protrudes in the form of a hernia, through the ruptured fibrinous tunic, is more untenable as a general position than that of Scarpa, who maintains the rupture of the two internal tunics in every case of the disease. Both these opinions are true in certain cases, but not in all." John Hunter, Scarpa, and Home, removed the external and middle coats of arteries in various experiments on living animals, with the view of ascertaining whether the force of the circulating current would dilate the inner coat into an aneurism; but they found that instead of an aneurism resulting, effusion of lymph took place, and the part healed without any change of size in the channel of the artery.

5th. The *dissecting* is comparatively a rare variety. Laennec has given an account of one example, and Mr. Guthrie of two. In the case mentioned by Laennec, the aneurism was very extensive; yet the person was not suspected, during life, of having any disease of the vascular system. The aneurism extended from the arch of the aorta to its division into the common iliacs, and is the largest example of this variety on record. "The internal and middle coats had been divided by a narrow transverse fissure, extending over two-thirds of the circumference of the artery; and the blood, instead of extending the external coat into a sac, had insinuated itself between it and the middle fibrous coat, and dissected them from each other, through more than half the circumference of the artery, from the arch of the aorta down to the common iliacs." Here the aneurismal sac was formed on one side by the external coat, and on the other by the middle and internal coats. In one of the cases recorded by Mr. Guthrie, there was a fissure about half an inch in extent, by which the blood escaped through the inner and middle coats, and effected a separation of the middle and external coats, so as to form a pouch about six inches in length in the anterior part of the descending aorta. In the other example mentioned by Mr. Guthrie, the inner and middle coats of the aorta were divided along half the circumference by a very clean rent, situated opposite to the origin of the arteria innominata, and the separation of the external and middle coats extended on the one side from the rent to the origin of the aorta, and on the other to a point opposite to the origin of the left subclavian. Laennec was the first writer who gave a minute description of this curious variety, and it has been carefully investigated by Rokitansky, who gives an account of eight cases which came under his own observation. Stosch, Guthrie, Shakelton, Smith, Nivet, Goddard, Pennock, and many others, including myself, have recorded examples of this kind of aneurism. In almost all these examples, the heart was diseased, and more especially its left side; in some instances, there was dilatation with hypertrophy; in others, dilatation with attenuation; and in many of them there were evident signs of steatomatous and calcareous deposits. According to Rokitansky, it sometimes commences by disease of the middle and internal coats, in which case the continuity of these coats is destroyed, and the separation of the external coat follows as a later effect; in other instances, it is the consequence of chronic inflammation of the external coat, which gives rise to separation of that coat, followed by rupture of the middle and internal coats. In the one set of cases he considers that the rupture precedes, in the other, that it follows, the separation. Dissection has revealed four varieties:—1st. Those in which the blood effects a separation of coats, and at last escapes by giving way of the internal coat; 2nd. Those in which the blood, after separating the coats and forming a dissecting aneurism, reaches a spot where the artery is the subject of fatty degeneration, and makes its way again into the vessel; a remarkable instance of this variety was recorded by Shakelton; 3rd. Those in which the blood remains between the coats, without escaping through the external coat, or again entering the artery through a second opening of the inner coats; 4th. A variety in which the blood escaped into the pulmonary artery, and of which the following is the only case on record:—In the body of a man about fifty years of age, who had not been supposed to be the subject of any disease, and who died very suddenly, before any medical man had an opportunity of seeing him, I met with a singular variety of dissecting aneurism. In the arch of the aorta, about three-fourths of an inch to the left side of the origin of the left subclavian artery, there was a rent of the inner and middle coats; from this rent to near the origin of the aorta on the cardiac side, and for upwards of an inch on the capillary side, the external coat was separated from the middle, round nearly two-thirds of the circumference of the artery. There was an opening upwards of half an inch in diameter, by which the aneurism thus formed burst into the pulmonary artery, a little below the place where that vessel gives off its two branches. The aorta was affected with steatomatous deposit in many places, and in this case there were, beyond all doubt, patches of the same kind of degeneration in the pulmonary artery. There was very slight hypertrophy of the left side of the heart.

IV. *Contents of the Sac.*—The contents of an aneurismal sac are not the same at all periods; they vary considerably, according to the length of time that has elapsed from the commencement of the disease. At first the sac contains only fluid blood, and in this stage, by exerting pressure on the swelling, or on the artery leading to it, the aneurismal sac is readily emptied. In the next stage, the contents consist partly of fluid blood, and partly of a solid substance, the nature of which will be afterwards described, bearing but a small proportion to the fluid. In a yet more advanced stage, the sac still contains both fluid blood and coagulum; but the proportion of the latter to the former is greatly increased. When after death an opportunity is afforded of examining an aneurism of some standing, the sac is found to contain what is technically called the coagulum, consisting of two parts, namely, blood more or less firmly coagulated, the coagulation having probably taken place subsequent to death, and a lamellated fibrinous concretion. This fibrinous concretion is found to consist of numerous concentric laminæ, varying in firmness according to their situation; those nearest to the blood having usually a soft and somewhat reddish appearance; those farther removed being more dry, more pale, and more adherent; and the external ones in contact with the sac, having a very opaque, dry appearance, and being of a somewhat friable consistence. A most important change which takes place soon after the occurrence of aneurism, is the commencement of the formation of the fibrinous concretion. The blood, after the formation of the aneurism, leaves upon the internal surface of the sac a layer of coagulum, and this being followed by successive depositions of fibrin, the lamellated concretion is gradually formed. If the form of the sac be such as to admit of the retardation of the current of circulation in it, as in a sacculated aneurism, having a narrow communication with the arterial trunk, the coagulum is formed much more readily; and this explains a most important difference in the pathological conditions of an aneurism, and a simple dilatation of the artery; for in the latter, where the surface is smooth, and no retardation of the current of blood can take place, there is no fibrinous concretion, and consequently no means of protection for the weakened part.

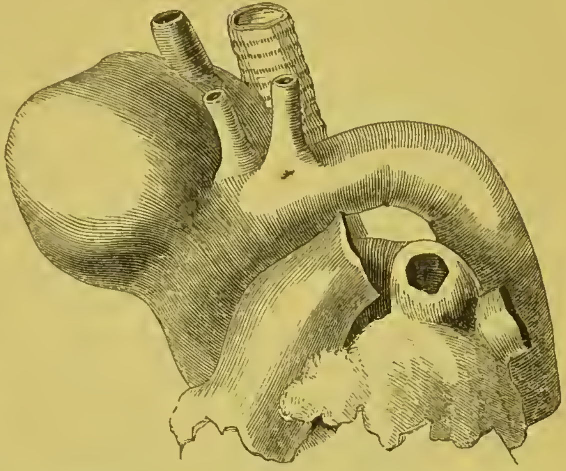
Fig. 180.



Farther growth of aneurism prevented by coagulum becoming adherent to the artery around the opening of the sac.—From Hodgson.

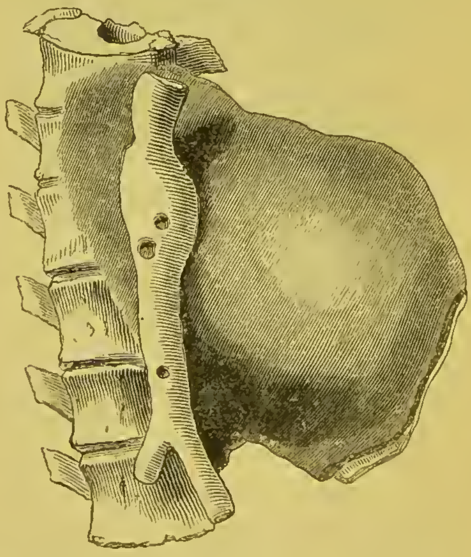
V. *The various ways in which Aneurisms prove fatal.*—1. Aneurisms frequently prove fatal by making their way to the surface of the body, or to the mucous canals, or to the serous cavities. When an aneurismal tumour reaches the surface of the body, it never bursts by laceration, but the attenuated integument sloughs, and on the separation of the slough, an escape of blood takes place. The flow of blood is for a time arrested by a part of the coagulum forming a plug, but by and by, the hemorrhage returns, and the patient sinks in consequence of repeated attacks of it. The process is the same when the disease opens into the mucous canals, or into an organ lined with a mucous membrane, as the œsophagus, intestines, or bladder. The part does not give way by laceration, but after being attenuated by absorption, it is destroyed by sloughing. I have a preparation of an aneurism of the aorta, in which an opening was made into the trachea by the process above referred to, and the first discharge of blood caused death by suffocation. Aneurisms frequently prove fatal by bursting into some of the serous cavities, as the cavities of the pleuræ, that on the left side more frequently than that on the right, the peritoneum, the serous cavity of the tunica arachnoidea, or the pericardium. Of the last, examples were seen by Morgagni, Sir Astley Cooper, and others; and I have a beautiful specimen taken from a man who died suddenly, in whose pericardium I found a large quantity of blood, the fatal rent being about an inch in length. In the two former modes of fatal termination, the integument, or mucous membrane, after being attenuated by absorption, gives way by sloughing; in the last, the serous membrane gives way by a rent. In the third mode, and some-

Fig. 181.



Aneurism of arteria innominata, which proved fatal by bursting into the trachea. From a preparation in my own museum.

Fig. 182.



Aneurism of the aorta, which induced caries of the vertebræ, and fatal compression of the spinal cord. From a preparation in my museum.

times in the second, death results from a single discharge of blood; but in the first, from repeated hemorrhages. 2. Death may be caused by pressure on important parts, as the trachea, the bronchial tubes, the lungs, the œsophagus, the thoracic duct, of which Laennec witnessed an example, or the spinal cord. I have several specimens of aneurisms which proved fatal by pressure on the spinal cord; in one of them the bodies of two vertebræ, and in another those of three, are entirely absorbed on the left side of the spine. 3. By constitutional irritation, the system sympathizing with the local irritation. 4. Aneurisms may prove fatal in consequence of inflammation attacking the sac and surrounding parts, and giving rise to suppuration and the formation of large abscesses. 5. Death may ensue from the bursting of the aneurism, and the escape of blood into the surrounding textures.

Such are the most frequent modes of fatal termination of aneurisms; there are others which, though of extremely rare occurrence, are occasionally met with. In an individual not suspected of labouring under any disease, who died instantaneously one morning, while rising out of bed, and whose body I was requested to examine, death was caused by an aneurism of the aorta bursting into the right auricle of the heart. This mode of fatal termination has also been seen by others. I have in my possession a specimen taken from a case in which death was caused by an aneurism of the aorta making its way into the pulmonary artery. In some instances of aneurism of the aorta, it has been found on dissection, that fatal destruction of the circulation resulted from a portion of the coagulum falling from the sac into the artery.

Fig. 183.

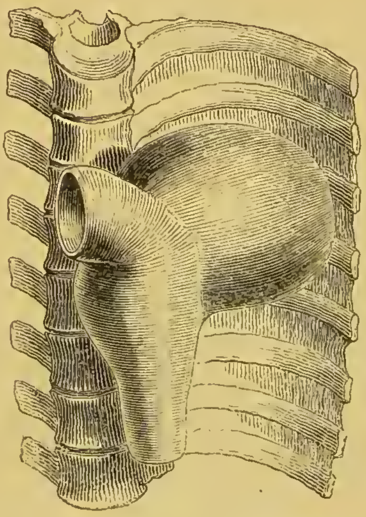


Fig. 184

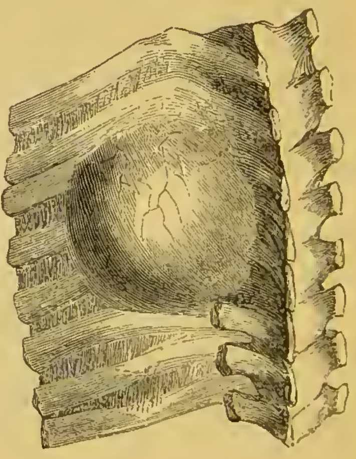
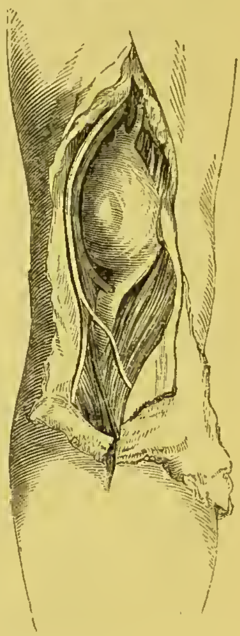


Fig. 183.—Front view of aneurism of aorta. From a preparation in my museum.

Fig. 184.—Back view of same preparation, showing the aneurism producing absorption of the ribs, and making its way to the surface. Death was caused by part of the coagulum falling into the artery.

VI. *Symptoms.*—Sir A. Cooper says, "With respect to external aneurisms, the symptoms may be divided into three stages. When you have an opportunity of seeing aneurism in its early stage, you will find a small tumour pulsating very strongly—much more strongly than in any subsequent stages; for it may be taken as a general rule that the force of the pulsation is in the inverse proportion of the size of the aneurism. When an aneurism is first formed, it contains only fluid blood; and if you apply your finger to the artery between the aneurism and the heart, you will readily empty the aneurismal bag. In this state there is scarcely any pain, and no other alteration in the limb than some irregularity of circulation producing spasm in the muscles; and when the patient is going to rest, cramps in the legs and sudden twitchings, which prevent him from sleeping. The next state in which we find aneurism is, when the blood is beginning to coagulate in the interior of the sac, the coats of which are very considerably thickened. At this time, if you press on the artery, you may empty the sac in part; you will see the swelling reproduced when you take off the pressure. You cannot completely empty the bag by pressure, for a considerable degree of swelling will still remain. There is some degree of pain in the limb below in this stage of the disease, in consequence of the size of the swelling, and the pressure on the surrounding parts. The aneurism becomes a solid swelling, instead of a mere bag containing fluid blood, and the circulation is retarded by the pressure on the surrounding parts. In the next stage, the aneurism has acquired considerable magnitude, and the pulsation is, in a great degree, lost. Pulsation may be observed in some one part opposite to the opening from the artery, but it is seldom perceived over the whole swelling. A small portion of the blood still continues in a fluid state, but the greater part of it is filled with coagulum."

Fig. 185.



The principal symptoms of external circumscribed aneurism are a swelling, pulsation synchronous with the heart's action, and at each pulsation an elevation of the tumour, a heaving or uniform enlargement, a peculiar thrill felt on applying the hand, and a sound like that of a bellows perceptible on applying the ear. For the purpose of diagnosis, it is of the utmost importance that the characteristic peculiarities of these symptoms should be clearly understood.

1. *The swelling* at first is small, but its increase is gradual; "seldom so rapid as the outward bulging of an abscess; seldom so tardy as the enlargement of any tumour not malignant." In the first stage

it is soft, and may be reduced by pressing the tumour or the artery leading to it; in the second stage it is a little harder and less compressible; and in the third stage it is still harder, and very slightly, if at all, susceptible of diminution by pressure. To whatever extent the tumour may be compressible, it immediately returns to its former size on the discontinuance of the pressure. By pressure on the trunk, leading from the aneurism, the tumour is increased.

2. *The pulsation* is synchronous with the action of the heart, and is much more perceptible, both to the touch and the sight, in the first than in any subsequent stage. In the second stage, the pulsation, in consequence of the deposition of fibrin, may be less distinct in certain parts of the tumour than in others; hence it is said not to be "equal in all directions." In the third stage, the pulsation is still further diminished, and may be limited to certain parts; and it is scarcely, or not at all, perceptible, if the sac be nearly filled with lamellated fibrin. The absence of pulsation, therefore, is no certain proof that a tumour is not an aneurism; nor is the presence of pulsation any proof that it is; for a tumour or an abscess may have pulsation communicated to it by its being situated over an arterial trunk, and in the case of an abscess so situated, the fluid nature of its contents renders the pulsation very deceptive. It will assist in diagnosis to remember, that the pulsation of an aneurism cannot be changed by any alteration in the position of the limb; but that the pulsation communicated to a tumour in the neighbourhood of an artery, may be diminished or suspended by placing the limb in such a position as may remove the tumour from the artery, or by lifting the tumour off the artery, or pressing it aside.

3. *Elevation* of the aneurism is perceptible, and is always synchronous with the pulsation.

4. A *heaving*, or *uniform enlargement*, or *distinct expansion at every point*, simultaneous also with the pulsation, is quite diagnostic of aneurism. The impression communicated to the fingers of the examiner is, that the expansion is caused by the injection of a fluid into a cavity. This symptom differs very much from the pulsation or change of place of a tumour occasioned by an impulse from a neighbouring artery. The presence or absence of this symptom should be minutely inquired into, in the examination of every swelling supposed to be aneurismal.

5. The *peculiar thrill*, or rasping sensation, felt on placing the fingers over the aneurism, is supposed to be produced by the blood rushing over a rough surface.

6. The *sound, like that of a bellows* (*bruit de soufflet*), is discoverable either by mediate or immediate auscultation. This sound, however, is no certain proof of the existence of aneurism, as it is well known that it may be produced by a tumour diminishing the calibre of an artery; it may be made perceptible by compressing an artery with the stethoscope, more especially if the individual be in a state of

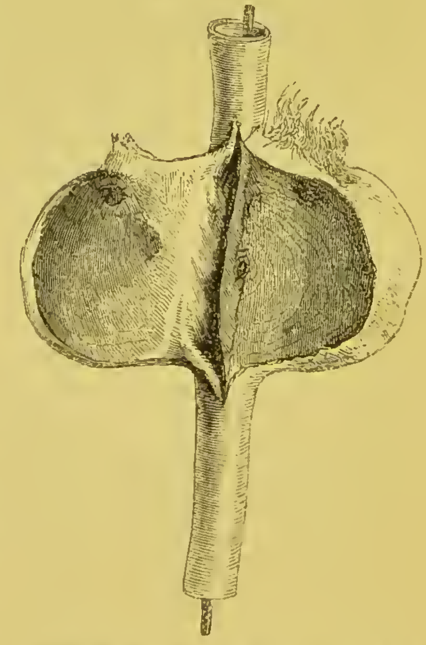
nervous agitation; and it has often been perceived where, on dissection, no lesion of the coats of the arteries could be discovered. Of all the symptoms, the uniform expansion simultaneous with pulsation is the most unequivocal. The history of the symptoms often affords valuable assistance in making out the diagnosis in difficult cases.

The following symptoms, often called pressure-symptoms, though not distinctive characters, usually attend aneurism in a greater or less degree at some period of the disease. If an aneurism arise from dilatation, there is usually no pain at the period of its formation; if there be first dilatation and then rupture, the pain is trivial; but if the aneurism originate in rupture, sharp pain is felt at the formation of the disease; and in all cases there is ultimately more or less pain or uneasiness, when the swelling attains great size in an advanced period of the disease. Œdema of the extremity, weakness, numbness, spasmodic twitchings, and sensations from compression or stretching of surrounding structures, are symptoms of frequent occurrence. If an aneurism be in the neighbourhood of a joint, it usually interferes to a considerable extent with the motion of the articulation.

VII. *Spontaneous Cure.*—Nature sometimes, though very rarely, effects a cure; and an aneurism, therefore, which is not accessible to surgical treatment, does not invariably terminate fatally. The processes by which a spontaneous cure may be effected are the following:

First. The most frequent manner of a spontaneous cure is, by the sac becoming filled with lamellated coagulum. The various stages of this mode of favourable termination, first minutely described by Hodgson, and afterwards minutely investigated by many other competent observers, are the following:—The sac becomes completely filled, so as to preclude all further entrance of blood. The artery, by deposition of coagulum, becomes impervious as far as its nearest considerable branches, and is ultimately converted into a small impervious cord—the circulation in such cases being maintained by the blood, which is received into the branches given off from the arterial trunk above the aneurism, being discharged into branches given off from the trunks below, and conveyed through the last-mentioned branches by inverted circulation into the trunks from which they

Fig. 186.



Spontaneous cure of aneurism of femoral artery by the sac being filled with coagulum; the vessel remaining pervious. From a preparation in my museum.

originate—both sets of branches becoming much enlarged. Or the artery may remain pervious, the blood passing over the closed-up sac at the part where its mouth communicated with the vessel. The tumour becomes smaller and harder in consequence of absorption. Petit records a case of spontaneous cure, in which the aneurism, at one time as large as an apple, became as small as an olive. Examples of this mode of spontaneous cure are to be found in the writings of most surgical authorities on this subject. The accompanying drawing is taken from a very good example in my own collection of preparations. *Second.* In some examples where the whole circumference of a vessel has become aneurismal, a spontaneous cure has been effected by a canal being left through the centre of the lamellated coagulum, through which the blood continued to circulate. There is reason to believe this to be an extremely rare mode of spontaneous cure. *Third.* It occasionally happens that from over-distension, or some other circumstance, inflammation of the sac and surrounding parts intervenes, and goes on to gangrene, the whole of the aneurismal tumour sloughing away, and by that means a spontaneous cure is effected ;—hemorrhage from the vessels leading to the part being prevented by the same process as when gangrene takes place in other circumstances. *Fourth.* Another mode is by the aneurism pressing on the trunk leading to or from the aneurism, so as to obstruct the circulation. If the size and position of the tumour be such as to cause an approximation of the opposite sides of the artery either on the cardiac or capillary side, there can be no doubt that a cure will be the result. When the pressure is on the cardiac side, the cure is effected on the same principle as in one of the modes of surgical treatment described in the next section. *Fifth.* Pressure on the trunk leading to the aneurism may be produced by other causes than the aneurism itself, as by a tumour not aneurismal, or by another aneurism on a neighbouring artery ; and thus a spontaneous cure may result. Liston records an example of subclavian aneurism, which on dissection was found to have been cured by an aneurism of the arteria innominata. *Sixth.* The same favourable result will follow, when inflammation takes place in the artery, and fills its calibre with coagulum. *Seventh.* Sometimes a portion of lamellated fibrinous coagulum becoming detached falls into the sac, and thus causes diminution, or complete occlusion of the mouth. In the latter case, coagulation of the blood in the sac must take place, and in the former the consequent diminution of the circulation through the sac is much calculated to promote deposition of fibrine, and to accomplish a spontaneous cure. In this mode the artery may or may not become impervious. *Eighth.* A portion of the coagulum may fall into the artery and obstruct it, thus effecting a cure. Or, *Ninth.* The aneurism may burst and become diffuse. If the presence of the diffusely infiltrated blood do not give rise to the untoward consequences formerly described, it may by its pressure on the cardiac side of the tumour so weaken the force of the circulation through the aneurism, as to promote the deposition of lamellated coagulum, or to arrest the circulation of the fluid parts of the contents of the sac, and thus promote their coagulation. Such are the methods by which nature sometimes, though rarely, effects a spontaneous cure; and it may be a consolation to patients who are subjects of aneurisms in inaccessible situations, to know that their case is not hopeless, and that a spontaneous cure is not impossible.

TREATMENT OF ANEURISM.

The treatment of aneurism is of two kinds—medical and surgical. Medical treatment can alone be employed in internal aneurisms, and surgical is applicable to those which are external.

Medical Treatment.—The indications to be fulfilled by medical treatment are, to reduce the quantity of blood, and the force and frequency of the heart's action, so as to diminish the eccentric pressure upon the walls of the aneurism, and to increase the plasticity of the blood, for the purpose of favouring the deposition of laminated fibrine. The means for accomplishing these objects vary according to the state of the patient. In all cases, perfect rest in bed, freedom from all mental or bodily excitement, removal of all sources of irritation and of influences capable of causing disordered secretions, are indispensable. In other particulars, the treatment varies according as the patient is in a hyperemic or anemic condition of system. If the patient be in a hyperemic state, when the impulse is usually strong, and the progress of the disease rapid, along with the use of the above-mentioned means, total abstinence from stimulants, reduction of the diet to six ounces of bread in the day, two ounces of animal food, and a little milk and water, the occasional use of a saline aperient, and if the heart's action be very strong, venesection to a small extent, constitute the proper treatment; whereas, if the patient be of an anemic habit, nutritious, but solid animal diet, little liquid, preparations of iron, and the occasional use of opiates, are the most favourable remedies for removing the weakness and irritability of system, for obviating the defect of fibrine in the blood, and for promoting the deposition of stratified fibrine in the sac. Such are the views entertained at present as to the principles by which we should be regulated in the medical treatment of aneurism. They appear rational; and although a cure by medical treatment is comparatively of rare occurrence, yet their adoption in some cases has been followed by the desired result; and when they cannot avert, they tend to delay the fatal result. Pelletan, Hodgson, Tuffnell, and others, have seen favourable results from medical treatment; and I met with one instance of a sacciform aneurism of the aorta, where a perfect cure took place under this mode of treatment. The medical treatment of aneurism was originally proposed and practised by Valsalva and

Albertini. It has been designated their treatment of aneurism, and from their recommendation and that of others, it acquired a celebrity, which, however, it has not maintained. Valsalva and Albertini reduced their patients, by repeated abstractions of blood, to such an extreme degree of debility that they could scarcely raise their arms from bed; they enjoined the most perfect quietude, both of body and mind; they directed that their patients should be kept constantly in the horizontal posture in bed; and that their diet should be of the most unstimulating kind. They gradually reduced the quantity of food to half a pound of pudding in the morning and a quarter of a pound in the evening, forbidding everything else except a limited quantity of water. When the strength of the heart's action was reduced to such an extent that the patient could scarcely be raised from the horizontal posture without danger of fainting, the diet was then gradually increased. Such was the medical treatment of aneurism practised by Valsalva and Albertini. Its efficiency in arresting the progress of internal aneurisms and accomplishing a cure, they believed they had proved, and so also did Pelletan and others; but be that as it may, there is reason to believe that its effects have been much overrated, and there can be no doubt, that few will submit to its employment to the extent practised by Valsalva and Albertini; that in some persons it is not free from the danger of proving fatal, by inducing other disease; and that in all its details, it is not suitable for the opposite conditions of system met with in those who are the subjects of aneurism.

Surgical Treatment.—Until John Hunter, in 1785, proposed and practised his operation for the cure of aneurism, the treatment adopted was either amputation, or the employment of pressure, or the performance of some one or other of the following operations. One of the earliest operations we read of is that which was practised in the time of Celsus, who lived in the beginning of the first century of Christianity, and was the most elegant writer on medicine and surgery among the Romans. In those days the practice was to open the tumour, to clear out its contents, and to endeavour to stop the hemorrhage by thrusting the actual cautery into the wound—a procedure almost invariably fatal, and it would have been very surprising if it had been otherwise. Another operation is that which was practised by Rufus the Ephesian, a zealous surgeon who flourished in the beginning of the second century, in the time of the Emperor Trajan. He first, by means of a ligature, secured the artery immediately above the aneurism, and then cut into the tumour and removed its contents. Antyllus, who is generally believed to have flourished in the beginning of the fourth century, followed the example of Rufus in cutting into the aneurismal swelling, and removing its contents; but he previously tied the artery below, as well as above the swelling, and endeavoured to heal the wound by granulation. Such were the operations practised among the Romans. The Greek and Arabian writers recommended an operation in some measure different from those practised among the Romans, and, in one particular, bearing a resemblance to that in use at the present day. Aëtius, a native of Amida, and a pupil of the celebrated School of Alexandria, who flourished in the middle of the sixth century, and the celebrated Paulus Ægineta, also a pupil of the Alexandrian School, who lived about the middle of the seventh century, both practised the same operation. Aëtius recommended for the cure of aneurism at the bend of the arm, to include the brachial artery in a ligature a little below the axilla, and then to evacuate the contents of the aneurism: the peculiarity of this method was, the application of the ligature at a considerable distance from the aneurism. Paulus Ægineta not only practised this operation for the cure of aneurism at the bend of the arm, but adopted it also in aneurisms in various other situations. Such was the practice recommended by the Greek writers. These operations were succeeded by one still more formidable and dangerous, which consisted in opening the aneurismal sac, clearing out its contents, then searching for the artery and securing it by a ligature, both above and below, at its openings into the sac. This horrible and dangerous procedure was always attended with extreme pain and irritation, and was for the most part fatal, as might have been anticipated, considering the many hazards which the patient had to encounter. Another operation, practised by Guattani and others, consisted in laying open the sac, removing its contents, and applying graduated compresses to the extremity of the artery at the mouth of the sac. In performing this operation, some surgeons, among whom was Guattani, endeavoured to arrest the hemorrhage by pressure alone, using compresses for this purpose; others, retaining the use of compresses, also applied styptics. After the introduction of the tourniquet by Morel, towards the end of the seventeenth century, the danger from loss of blood during the operation was diminished, as hemorrhage could be prevented until the surgeon had accomplished the immediate object of his operation. Whoever reads the description of their operations, as given by Guattani, Deschamps, Pelletan, and others, will readily admit that few things in the history of surgery are more horrible, and that it is not, therefore, very surprising that many surgeons in those days arrived at the conclusion, that until a safer and more successful mode of operation should be discovered, the most advisable procedure was amputation, which, accordingly, was often resorted to. Another operation was, however, before long suggested—namely, the method so successfully practised at the present day, of tying arteries. It seems very surprising that there has been so much difference of opinion as to whether this operation should bear the name of Anel, of Desault, or of Hunter, when, by a careful examination of the then practice, it is so easy to determine the merit which belongs to each of these great men.

To Anel undoubtedly the merit belongs of having first introduced the important principle of not interfering with the aneurismal sac, but leaving it entire; he tied the artery above the sac, but as close to it as possible. This method he successfully practised on the brachial artery in 1713; the important point in it is, the placing of the ligature on the artery, and not interfering with the tumour.

The treatment which was practised by Anel for aneurism of the brachial artery, Desault applied to a case of aneurism of the popliteal artery in the Hôtel-Dieu, Paris, in the month of June, 1785—the same year in which Hunter performed his first operation. The grand objection to the method practised by Anel and Desault is, that the artery was tied as close as possible to the aneurismal sac; its recommendation is, its principle of not interfering with the tumour.

Treatment by Ligature.—To John Hunter undoubtedly belongs the merit of suggesting the method now so generally adopted, and of establishing its success by experience. In Hunter's method, to which he was led by a consideration of the physiological principles applicable to the cure of this disease, the aneurismal sac is not interfered with, and the artery is tied on the cardiac side of the tumour, at a considerable distance from it, where the artery is easily accessible, and where its coats are more likely to be free from disease, the removal of the aneurism being left to the action of the absorbents. Hunter performed his first operation in St. George's Hospital, London, in December, 1785, a few months after Desault's operation in the Hôtel-Dieu, Paris, in a case of popliteal aneurism, for the cure of which he tied the femoral artery; and the desired result was obtained. This mode of operation is justly regarded as one of the greatest improvements in surgery, nor can there be any question that Hunter is entitled to the praise of having first suggested it and proved its success. It has been said "that those who render themselves useful to their fellow-men by their important discoveries in the sciences belong to every country, and that they deserve praise from one pole to the other; but it seems to us, also, that each nation may, without being taxed with egotism, claim for itself and attach to its own soil the discoveries or improvements which are its property, and which tend to increase its scientific glory."

As the effects of a ligature properly applied to an artery, and the various changes which result, have already been minutely described in a former section, it seems unnecessary to do more than to refer to that description, and to add, that the immediate objects the surgeon wishes to accomplish are, greatly to diminish the quantity, and to enfeeble the circulation of blood in the sac, which will be indicated by slight contraction of the sac at the moment the force of the blood is arrested by the application of the ligature, the arrest of both the pulsation and the bruit, and followed by the deposition of stratified fibrine in concentric layers within the sac, until the tumour becomes entirely solidified.

The ultimate condition desired of the contents of the sac is, their entire solidification by the deposition of laminated fibrine, and with the view of obtaining that solidification, the immediate effect wished to be produced on the circulation through the sac by the application of the ligature is, that the circulation of blood in the sac should be enfeebled, but not arrested. The absence of either of these conditions, instead of being desirable, may be the cause of failure. Too forcible circulation, persisting or returning after deligation, may prevent the deposition of fibrine; and, on the other hand, a certain amount of flow of blood through the sac is necessary to allow of the deposition of fibrine; but, besides, complete arrest of circulation in the sac is followed by coagulation of blood. The coagulum acts as a foreign body, gives rise to suppuration, gangrene, or other untoward results, and in large aneurisms, in some situations, is one of the frequent causes of death after operation. The desirable state after deligation is a continuous but not pulsatory stream, and by collateral circulation and regurgitation, this necessary amount of circulation is usually obtained. Abnormity of the vascular system, or too free collateral communication, may allow sufficiently forcible circulation to cause return of pulsation. The appearance of this symptom has sometimes, but not in the great majority of cases, been attended by return of bruit. Recurrent pulsation is much more common in some aneurisms than in others; for example, it is much more common in aneurism of the common carotid than in aneurism in the under-extremities; and in all cases it is a symptom that gives rise to anxiety; but in the great majority of instances it disappears under the use of rest, dietetic regulations, the cautious employment of cold, and, where advisable, very gentle pressure over the aneurism. In all cases of operation it is of the utmost importance that a favourable condition of the circulation and of the constitution of the blood should be obtained by medical treatment before venturing on operative proceedings.

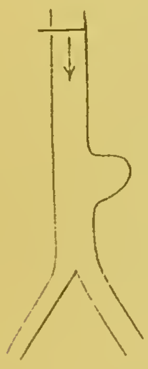
The tumour is gradually diminished by absorption; and, with regard to the condition of the main trunk on which the aneurism is situated, it has been found, in some instances, that it has become obliterated from the first branch above the ligature to the first below the aneurism, an example of which is mentioned by Sir Astley Cooper, where the obliteration extended from the origin of the deep femoral artery to the commencement of the tibial arteries.

But such an extent of obliteration is extremely rare; and in most specimens which have been examined and recorded, it has been found that the trunk has been obliterated in two situations, namely, from the first branch above the ligature to the first branch below it, and for a short distance above and below the aneurism: so that an insulated portion of the artery preserves its cavity between the obstructed parts, and a double collateral circulation connected with the insulated portion assists in maintaining the circulation through the extremity.

By one collateral circulation blood is conveyed from the arterial trunk above the ligature to the upperpart of the insulated portion; and by the other, from the insulated portion to the main trunks on the distal side of the aneurism. At the time when Hunter performed his operation, the proper method of applying a ligature to an artery was not known; and to prevent hemorrhage, various plans were adopted, which were calculated to ensure the occurrence of the event they were intended to avert. Some of these methods were, the application of ligatures of reserve, tying the ligature very loosely from a dread of dividing too early the arterial coats, the application of pieces of tape for ligatures, and the introduction of soft bodies, such as pieces of cork, between the ligature and the artery. But the experiments and the investigations of Jones, Stilling, Spence, and others, having discovered and established the principles which should be the guide in applying a ligature to an artery, the Hunterian operation has, by the application of these principles, been brought to its present state of perfection. The site selected for the operation should not be so near to the aneurism as to interfere with the artery where its coats are the subject of degeneration, nor so distant from it as to risk the danger of too free a collateral circulation. The ligature should be small, round, and firm; the artery should be exposed as little as possible in front, only so far as to admit the point of the needle into contact with the artery; and laterally and underneath, only by the track of the needle. The ligature should be tied very firmly, so as to divide the inner and middle coats; one end of it should be cut off, and means used to promote union of the wound by the first intention. After the operation, the limb should be placed in a convenient position, the part where the vessel is situated being relaxed. The temperature of the limb usually falls a little, but it soon rises; and as the collateral circulation becomes established, it rises above the natural standard. While the temperature is below that standard, it is extremely injudicious to interfere in any way, except by covering the limb with flannel, or some soft cloth; for reaction speedily comes on without interference; and there can be no doubt that in various instances where gangrene has followed, it has been the result of excessive reaction induced by the application of heat and stimulants during the depression which had been occasioned by the tying of the main trunk, and the consequent stoppage of the supply of blood. Until some time after the ligature has come away, it is necessary to enjoin, not only that the body be kept in perfect rest, but also that the patient should guard against any mental emotion, or any circumstance by which the circulation might be accelerated. At no period is this more necessary than at the removal of the ligature. In some few instances, but it is an extremely rare occurrence, the temperature does not rise above the natural standard at any period after the operation; the reason of which is supposed to be, that the collateral circulation had become fully established before the performance of the operation. From what has been stated it will be evident that only one ligature should be used. The only exception to this rule is, when from any circumstance it happens, that at the part where the artery is to be tied, it is injudiciously detached from its surrounding relations ; in such a case it is prudent to apply two ligatures, one at each extremity of the detached portion—a practice as ancient as the time of Aëtius,—and to divide the artery between them, or to leave it entire, as may seem advisable in the particular circumstances of the case.

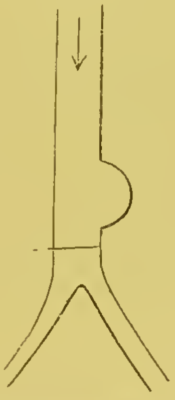
Three different kinds of operation by ligature have been practised ; namely, that of Hunter, that of Brasdor, and that of Wardrop. The following diagrams illustrate them :

Fig. 187.



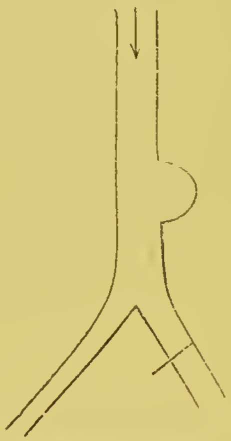
Hunter's mode.

Fig. 188.



Brasdor's mode.

Fig. 189.



Wardrop's mode.

From what has been stated, the nature and advantages of the *Hunterian operation* are, I trust, evident. It consists, as has been already explained, in tying the aneurismal artery on the cardiac side of the tumour, and at some distance from it. *Brasdor's operation* consists in tying the trunk of the artery on the distal side of the aneurism, and in its near proximity. *Wardrop's operation* consists in tying one of the two terminating branches of the artery on the distal side of the aneurism. Brasdor suggested that his mode of operation might be applicable to some aneurisms so placed as to render the Hunterian operation impracticable. Desault also recommended this mode, but neither he nor Brasdor performed the operation. Their contemporary, Deschamp, was the first who did; but it was under very unfavourable circumstances, and without success, in a case of aneurism as high upon the common femoral as Poupart's ligament. Sir A. Cooper was the next who practised this method ; it was in a case of aneurism of the external iliac; the common femoral was tied, but the patient died of the bursting of the tumour some time afterwards. These are the only two instances on record, in which during a period of more than forty years Brasdor's method was performed, and from their unfavourable results it fell into disrepute. To Wardrop belongs the merit of having first proved the success of Brasdor's operation. The subject of the operation was a female, seventy-five years of age, and the case was one of aneurism of the common carotid artery, where it was impracticable to tie the artery on the cardiac side of the tumour. He tied the carotid on the capillary side, and the result was successful. Wardrop performed this operation in 1825, and it has since been practised by Bush and others, in cases of carotid aneurism; and the results have proved, that although it is a mode of treatment, in principle obviously very inferior to the Hunterian method, and not generally applicable, yet a surgeon is perhaps justified in recommending it for certain aneurisms, situated so near the trunk as to render it impossible to tie the artery on the cardiac side of the tumour. It is obvious that the common carotid presents the most favourable conditions for the success of Brasdor's operation; because if it be not absolutely indispensable, there can be no doubt that it is highly desirable, that no vessel should originate, either from the sac or between the sac and the ligature. And from this it follows, that, as the number of aneurisms in which that condition can be obtained is comparatively few, the utility of the operation is proportionately limited, and, moreover, the danger of the operation is increased by making it necessary to include the artery in the proximity of the aneurism.

For my own part, I have never been able to form any but the most unfavourable opinion of the principle of the distal operation. The flow of blood through the sac is no doubt arrested, but its contents are not in a condition favourable for the deposition of stratified fibrine; and besides, if the contents remain fluid, there is no obstacle offered to the impulse of the heart producing eccentric distension; and if they become coagulated, the coagulum will, in all probability, lead to inflammation, ending in suppuration, gangrene, or other distressing results. But if the operation be bad in principle, it certainly is dangerous in practice, for of 27 cases collected by Erichsen, death speedily occurred in 20, and in the remaining 7, the results were far from being very satisfactory, although the patients escaped with their lives.

Wardrop suggested his operation of tying one of the two terminating branches of the artery, on the distal side, for the cure of aneurism so situated that neither Hunter's method nor Brasdor's can be adopted; as, for example, for aneurism of the arteria innominata; and he was led to do so by thinking, that if the circulation in the sac could be diminished, by stopping a portion of the blood passing through it, that would be sufficient to promote the deposition of laminated fibrine. With this view, he tied the subclavian beyond the scaleni for the cure of aneurism of the arteria innominata. The effect of this operation, as Wardrop believed, was to stop the passage of probably about one-third of the blood circulation through the sac, the two remaining thirds going to supply the carotid and the branches of the subclavian. The size of the tumour and its pulsation diminished; and, on the ninth day, pulsation returned in the right carotid; the obstruction of which, from the time of the operation, may have contributed to the result, which was to retard the progress of the disease, as the patient did not die till two years after the operation. Three modifications of this operation for the cure of aneurism of the innominata have been practised, namely, tying the subclavian in its third division, tying the common carotid, and tying both the subclavian and common carotid. 1st. Tying the subclavian alone has been performed three times. The operators were Wardrop, Dupuytren, and Langier. One of the patients died on the ninth day, another in a month after the operation, and in the third instance the patient lived for two years. 2nd. Tying the carotid alone has been performed eight times. The operators were Evans, Mott, Key, Fergusson, Morrison, Campbell, Hutton, and Wright. In one case only was the disease cured, and in that it was by inflammation and suppuration of the sac, which gave rise to destruction of the arteries of the right upper extremity, and of the carotid and its branches. Of the remaining 7 patients, 1 died in a few hours, 1 on the seventh day, 1 on the nineteenth day, 1 seven months after operation, 1 twenty months after operation, 1 on sixtieth day, and 1 on sixty-sixth. 3rd. Both the carotid and subclavian have been tied in 3 cases. The operators were, Fern, Wickham, and Rossi. In one case, the two operations were performed simultaneously, and the patient died in six days. In the second, nearly two years intervened between the two operations, and the patient died in three weeks after the second operation. In the third, the interval between the two operations was two months and a half, and the patient died from the bursting of the sac. The limits of this work will not allow me to give the details of the different cases, but from what has been stated it will be seen, that Wardrop's operation has been performed in one or other of its three modifications, 14 times in all; that in 1 case the disease was cured, in 1 retarded, and the remaining 12 died. It is my decided opinion that the principle of this operation is unsound and indefensible; but be that as it may, it is perfectly clear that its performance has been the means of diminishing instead of increasing the duration of life, and that it should now be excluded from the list of justifiable surgical operations.

TREATMENT OF ANEURISM BY PRESSURE.

Pressure has long been employed in the treatment of aneurism, and is much recommended by many of the earlier writers; but its good effects seem to have been much overrated: for although the records of surgery furnish examples of the cure of aneurisms in this way, there is reason to believe that until of late years, when it has been revived and employed on more scientific principles than formerly, the cures were in great measure owing to the quietude, abstinence, and depletion which were practised at the same time, and which, even though unaccompanied by pressure, would tend to promote a spontaneous cure. The pressure was applied sometimes to the whole limb, sometimes to the aneurism alone, and sometimes to the denuded artery; but the two methods most frequently adopted were, to apply it to the aneurism and the artery leading to it, or to the artery alone on the cardiac side of the tumour. The former of these two methods was adopted by Guattani, who was one of the greatest advocates for compression in the treatment of aneurism. He used firm compresses over the tumour and the artery leading to it, and applied a roller from the under part of the swelling to the upper part of the limb. He applied the roller anew, and somewhat more tightly, every eighteen or twenty days. With this local treatment he combined general bloodletting, rest, and spare diet. With regard to the result of this procedure, Guattani relates that, of 14 cases, 4 were cured; in 1, the treatment was discontinued on account of the pain; in 1, after the use of pressure for three years, an operation was deemed advisable; in 1, the tumour was diminished, but the result is not stated; and in 7, no benefit was obtained.

Guattani does not seem to have had an idea, that by this treatment he obliterated the artery and established a new circulation; but Scarpa conceived that when pressure effected a cure, it was by bringing into contact the opposite parietes of the vessel, and producing obliteration of the cavity of the artery by adhesive inflammation, a process to which the diseased condition of the artery is sadly hostile. In some instances Guattani employed pressure for the purpose of exciting suppuration in the swelling.

Pressure on the artery alone at some distance from the aneurism was the mode of treatment often adopted; the limb was left free, and the pressure which was employed with the intention of exciting inflammation in the vessel, and rendering it impervious by plastic deposition, was confined to the artery and to the opposite point of the limb.

This method was successfully employed by several of the French surgeons, particularly by Dubois and Dupuytren. Dubois cured several external aneurisms by pressure. In one case of popliteal aneurism, the pressure was applied on the front of the thigh on the 25th of February, and the patient was presented to the faculty of medicine in Paris on the 29th of the next month, completely cured. Other French surgeons tried this method of treatment; and in this country Blizard, Sir A. Cooper, Mr. White, and others; but the continued pressure necessary to induce obliteration caused such insupportable pain, that it was often found impossible to persevere with the treatment; and this circumstance, together with the local inflammation, sloughing, and constitutional disturbance, which often resulted, led to the abandonment of it in this country as a means of inducing obliteration of the vessel.

The treatment of aneurism by pressure has lately been revived entirely on new and improved principles. The new mode of employing pressure has been attended with the greatest success, and constitutes one of the most gratifying improvements in modern surgery. The ultimate object aimed at is, the consolidation of the contents of the aneurismal sac; and its attainment is sought by weakening the force of the circulation through the aneurism. For this purpose, pressure is applied to the artery leading to the aneurism at a considerable distance from the tumour, and employed to an extent only to weaken the force of the circulation, and not to produce obliteration of the artery. As this does not require severe pressure, the objections made to the former mode of treatment, that it was impracticable on account of the pain, and that the pressure often gave rise to severe and dangerous local results, cannot be urged against the method now employed.

The late Dr. Bellingham, one of the surgeons of St. Vincent's Hospital, Dublin, had the merit of having suggested this new mode of using pressure, and of having proved its success, as well as of bringing the subject before the profession. He treated a considerable number of cases with perfect success, and his method has been practised with equally gratifying results by other surgeons in Dublin and elsewhere. Bellingham stated, in regard to the favourable impression entertained of this mode of treatment, "So highly satisfactory has been the result of compression in Dublin, that no surgeon of that city would in the present day perform the operation of applying a ligature to the femoral artery for popliteal aneurism." Tuffnell, Cusack, Hutton, Carte, Porter, Greatrex, Newcomb, O'Farrell, and other eminent surgeons in Dublin and elsewhere, have treated aneurisms by this new method with perfect success; and it may now be said, that this mode of treatment has received the approval of all leading surgical authorities, with the exception of Syme, whose success in treating aneurism by Hunter's operation has been very great. Tuffnell's work on the "Treatment of Aneurism by Pressure," published in 1851, contains the following satisfactory report of the results in 39 cases of aneurism which occurred in Dublin during eight years:—"In 30, cure perfect and complete by pressure ; in 1, compression was discontinued, the aneurism not subsequently increasing in size ; in 2, the ligature was resorted to, and the artery tied with success ; in 3, amputation was necessary, each instance being followed by recovery ; in 1, death took place from erysipelas ; in 2, death took place from co-existing disease of the heart."

There are many aneurisms beyond the reach of pressure, and there are others in arteries to which it is not adapted ; but such facts cannot reasonably be urged as objections against this mode of treatment in cases to which it is applicable, especially as its employment is not attended with the slightest risk to the patient ; and even though it be unsuccessful, it will retard the progress of the disease, and interpose no obstacle to the subsequent operation by ligature.

When Bellingham first called attention to this interesting subject, he stated as his opinion, that it would be unnecessary to employ such a degree of pressure as would cause inflammation and obliteration of the artery at the seat of the pressure ; but that it would be sufficient merely to weaken the circulation through the artery and the sac, thereby favouring consolidation by the deposition of lamellated coagulum. In cases treated successfully by this mode, opportunities have occurred of making post-mortem examinations in consequence of the fatal results of other diseases ; and it must have been gratifying to Bellingham to find, that in most of these instances, the main artery was pervious everywhere except at the aneurism. After the Hunterian method, the main trunk is impervious at two parts, namely, at the ligature, and at the aneurism, and usually pervious between them ; after treatment by pressure it becomes closed only at the sac.

Various contrivances have been employed for applying the pressure. Most surgeons strongly recommend that the pressure should be constantly maintained and applied at different points, so as not to cause irritation of the skin ; hence it becomes desirable to have more pads than one in front of the artery. One appliance which has been used, is an arc of iron, with a pad behind, and two or more in front, moveable by means of screws ; one pad should be made to press against the artery, and when it causes discomfort, another should be applied against another point, after which the pressure by the former should be slackened. For the purpose of more decidedly changing the situation of the pressure, some use two instruments. The minimum of pressure necessary to control the circulation is applied by one instrument, and when the pain becomes irksome it is decreased, and compression is then applied by screwing up the other. The Signoroni Tourniquet has been employed for producing the gentle pressure, and for applying it at different points, according as it can be conveniently borne. The pressure may be renewed at the point where it was first applied, when the parts have recovered from the effects of the former application.

Hoey's clamp has also been employed. Carte's circular compressor, and Carte's compressor for the cure of femoral and popliteal aneurism, are preferable to any of the three above-mentioned appliances. An elastic force, derived from vulcanized India-rubber, is substituted for the unyielding pressure of the screw, and they will be found admirably adapted for the purposes for which they are intended. Some recommend the compression to be applied by means of a weight. This mode of compression is strongly recommended by Cusack, in an interesting paper on the Treatment of Aneurism by Compression, in the number of the "Dublin Quarterly Journal of Medical Science" for November, 1859. In that paper the causes of failure are pointed out; the results of experiments instituted with the view of ascertaining the weight necessary to arrest the circulation through the femoral artery are stated; and it is strongly recommended to make the pressure of an intermittent character. After trying many experiments, the conclusion was arrived at, that seven pounds and a half may be assumed as the amount of weight required, and that six, and eight and a half pounds, are the extremes of variation depending on differences in strength of arterial pulse. Cusack recommends that a weight of about four and a half pounds should be applied over the artery at the groin every alternate hour during the day, and withdrawn at night, and that after six days, when the collateral circulation has been fully established, the weight should be increased to eight and a half pounds, so as to imitate the effect of ligature, leaving it on but an hour and a half at a time. It will thus be seen, that there are diversities as to the means by which the pressure is applied, and also that there are varieties as to the mode by which it is sought to make the pressure as little irksome as possible; some, as Cusack, fulfilling the last-mentioned indication by making the pressure intermittent, while Tuffnell, and the great majority of those who have practised compression, by changing, as directed above, the spot at which it is applied.

During the sixteen years "the treatment of aneurism by compression has been put upon its trial," I have taken the greatest interest in this subject, and in October 1859, went to Dublin, for no other purpose than to satisfy myself, by personal observation, of the advantages of "the bloodless cure of aneurism." By the much-valued kindness of Mr. Tuffnell, I had the advantage of learning, and of seeing, all I possibly could desire to know and see regarding this mode of treatment. Mr. Tuffnell showed me cases under treatment in hospital; made a journey of nearly one hundred miles into the country to show me a large popliteal aneurism, the consolidation of which he had just effected by means of pressure; and demonstrated in the museums the extremely instructive preparations of vessels taken from the bodies of those who had died of other diseases after having been cured of aneurism—preparations of which I had previously read, and which it was exceedingly interesting to me to examine, and to hear the histories from Mr. Tuffnell. The result to my mind was, the firm belief that the treatment by compression is a safe, simple, successful, and almost painless mode of curing aneurism. The surgeons of Dublin can have no possible motive for preferring compression to operation, except the conviction that it is the preferable mode of treatment. In operative surgery "whatever men dare, they can do" as well as hands can do; but in suitable cases they prefer compression to operation, because they believe it the safer mode of treatment. It would be presumptuous in me to praise men so distinguished; but I may be permitted to say, that my instructive and delightful visit filled my mind with the highest admiration of the talents and skill of the surgeons of Dublin, and gave me a strong impression of the advanced state both of the science and art of surgery in that city.

APPRECIATION OF TWO MODES OF TREATMENT.

For the treatment of aneurisms of the carotids and axillary artery compression is quite unsuitable. Aneurisms of the upper extremity are generally false aneurisms of traumatic origin, and require treatment which will be described under the head of False Aneurism. Aneurisms in the under extremity admit of treatment either by compression or by ligature; and it will be found that the results of the treatment by compression contrast very favourably with those by Hunterian deligation. Broca analysed 127 cases treated by compression, and of these, 116 were successful, being in the ratio of 91 to 100, and only 6 died from the effects of treatment. On the other hand, Crisp, whose statistics give a lower mortality after ligature than any I have seen, states that, of 110 instances in which the femoral artery was ligatured for popliteal aneurism, 12 died. The cases, however, published by Bellingham and by Norris are perhaps as well calculated as any to give clear views of this subject. Of 32 compression cases given by Bellingham, 26 were cured; in 2, amputation was performed; in 1, the ligature was applied after pressure had failed; in 1, death was caused by erysipelas; in 1, death was caused by that disease; and in 1, the treatment was discontinued. Thus it appears that 2 died, being in the ratio of 1 to 16; and 6 failed, being in the proportion of 1 to 5·3. Of 188 cases recorded by Norris, in which the artery was ligatured, 142 were cured, and 46 died, being in the ratio of about 1 to 4. It appears, therefore, perfectly clear that it is the duty of the surgeon to prefer compression to deligation. Should compression fail, ligaturing the artery can still be resorted to, and certainly not with less, but with greater prospect of success; one danger of failure, namely, gangrene of the limb, being diminished by the increased collateral circulation caused by compression.

GALVANO-PUNCTURE, INJECTION, DIGITAL COMPRESSION, MANIPULATION, AND CONTINUED FLEXION.

Galvano-puncture.—This method of treatment was first suggested by Phillips, and revived by Pétrequin, Burci, and Bonnet. The operation is founded on the principle of the galvanic current having the power of coagulating the blood; and this is sought to be effected by introducing two long acupuncture steel needles into the sac, connecting them with a galvanic battery of moderate tension, keeping them in contact with each other, causing them to meet at different points, to afford a better chance of forming clots, and continuing the proceeding from 10 to 15 minutes at a time. The principle on which this operation is founded is not sound; as stratified fibre is the substance by which we desire to solidify an aneurism, and not coagulated blood. The proceeding is very painful, and not unattended with danger, and the results are not encouraging. Of 23 cases collected by Bonnet, 13 failed, and in 2 only could success be attributed to galvano-puncture. In the remaining cases, compression was employed, or doubts were entertained as to the results.

Injection was first suggested by Monteggia of Milan, who recommended solutions of acetate of lead, tannin, and other astringents; but many experiments were made on the lower animals by French surgeons, who gave the preference to a saturated solution of the perchloride of iron, which is introduced into the sac by means of a small glass syringe, the piston of which is moved by a screw, to secure the more steady introduction of the fluid, and to remove all danger of introducing more than five or six drops in all. A puncture is just made by an exceedingly small trocar and canula, the latter being retained in the sac until the fluid is introduced. During the injection, pressure should be made above and below the sac, to confine the blood during the proceeding. According to Malgaigne, of 11 cases, 4 were fatal, all had bad symptoms, and only 2 were successful. This proceeding is unsound in principle, and the results show that the adoption of it is not justifiable.

Manipulation.—Mr. Fergusson tried manipulation in two cases of subclavian aneurism; his object being to squeeze a portion of the coagulum into the artery in the hope of the current sending it into the distal portion, impeding the circulation through the sac, and leading to solidification of its contents. The repetition of this mode of treatment appears a matter of very questionable propriety, judging from the account of the instances in which it has been tried.

Digital Compression was first proposed by Vanzetti of the University of Padua, but was first successfully employed by Knight of New Haven, who cured a case of popliteal aneurism in forty hours; the compression having been applied by assistants. Gross reports 23 cases in which digital compression was used; of these, 15 were cured. Vanzetti has reported 6 successful cases, making 29 cases in all, of which 21 were cured. In 5 of the 15 cases, the digital alternated with mechanical compression. Gross writes, "The period required for the cure of aneurism by this method is incomparably shorter than by any other known plan of treatment. Thus of 14 cases, the shortest time required for a cure was three and a half hours, the longest being seven days, and the average two days and two-thirds. When compared with the cases cured by instrumental compression, the length of time is most striking. In the London hospitals, according to Mr. Hutchinson, the average time for the cure of 26 cases of femoral and popliteal aneurism was nineteen days; while Broca found that the mean duration of treatment in 91 cases was about fifteen days."

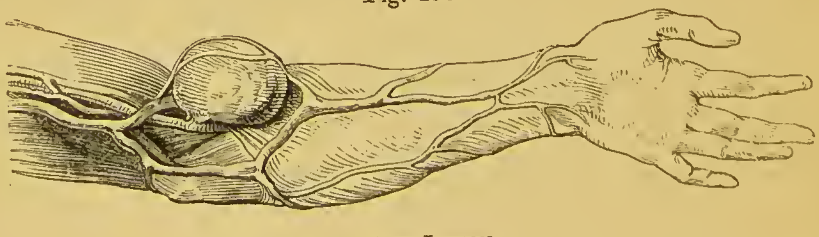
Continued Flexion.—Mr. Ernest Hart and Mr. Shaw succeeded in curing popliteal aneurism by continued flexion, as will be seen by perusing the "Medical Times" of May 7, 1859.

FALSE ANEURISM.

The various forms of false aneurism which are of traumatic origin, and usually result from unskilfulness in the performance of venesection at the bend of the arm, are—circumscribed false aneurism, diffused false aneurism, aneurismal varix, and varicose aneurism. Either of the first two varieties, however, may occur in any part of the body, if an artery be wounded; and either of the last two in any part where an artery and a vein in proximity to each other, are both wounded.

Circumscribed and Diffused False Aneurism.—These two varieties differ from each other principally in extent, and this depends mainly on the condition of the surrounding cellular tissue. If, when an artery is wounded, the surrounding cellular tissue or fascia, underneath which the blood escapes from the vessel, be dense or firm, a circumscribed false aneurism may be the result; whereas, if the surrounding tissue be loose and capable of dilatation, the aneurism which forms will be diffused.

Fig. 190.

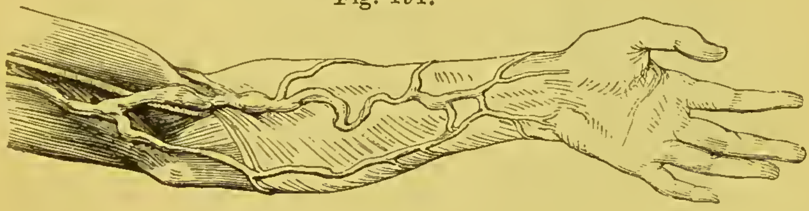


From Liston.

When an artery is wounded, as a grand object of treatment is to prevent the occurrence of aneurism, the energetic employment of pressure is most important; and the best means for this purpose are a graduated compress and a roller; a very necessary precaution, however, is the previous bandaging of the limb, without which, energetic pressure cannot be safely employed. If an aneurism be formed, the treatment must depend on the state of the parts. If, in consequence of partial consolidation of the contents of the sac, the aneurism be but partly compressible, either the Hunterian treatment may be adopted, or pressure according to the improved principles on which it is now applied to the treatment of true aneurism; but if the contents of the sac be entirely fluid, the proper treatment for effecting a complete cure consists in tying the artery both above and below the wounded part.

Aneurismal Varix.—When, in consequence of a wound, a direct communication is made between an arterial and a venous trunk, a disease may be formed which was first described by Dr. Wm. Hunter, in the year 1756, and for which, at a subsequent period, Cleghorn of Dublin suggested the name of aneurismal varix. This disease may occur in any part of the body where an artery and a vein, in proximity to each other, are both wounded; but it most frequently presents itself at the bend of the arm, and results from the transfixing of the median basilic vein, and the wounding of the artery in the operation of venesection. Thus three wounds are made before the disease takes place; one on each side of the vein, and one in the artery. The wound in the dermoid, or superficial side of the vein may heal, but that on the opposite side of the vein, and that in the artery, may remain open, and through these openings a communication may be established between the two vessels. The effects of this communication and direct ingress of the arterial blood into the venous trunk are, that the implicated vein suffers cylindrical widening, and becomes infected with sac-like dilatations; the artery, on the distal side of the disease, becomes generally smaller, and its coats thinner, in consequence, no doubt, of the diminished quantity of blood received into it; and on the cardiac side of the wound, the artery is usually widened, sometimes to a great extent, if the disease be of considerable standing. This last-mentioned condition, namely, the widened state of the artery on the cardiac side of the wound, is one which has

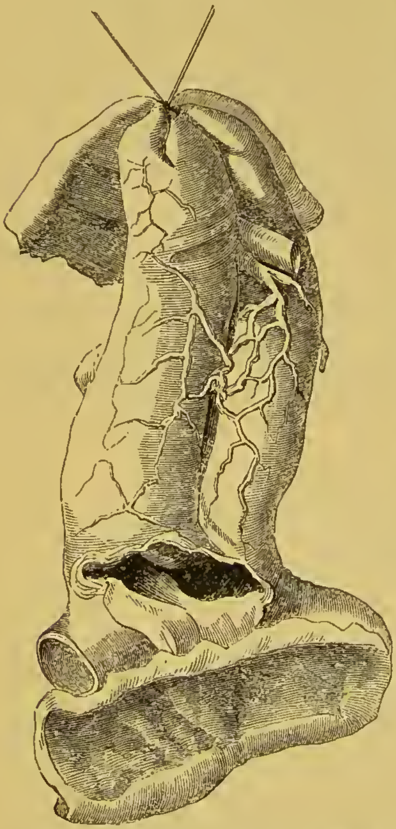
Fig. 191.



From Liston.

attracted the attention of various authorities; and before a surgeon ventures to recommend an operation, he must be well satisfied that it does not exist, or only in a very slight degree; because in the event of the artery being very much widened, its inner surfaces cannot be placed closely and uniformly in apposition; but the walls of the vessel will be puckered up by the ligature, and when the ligature is removed, hemorrhage will, in all probability, result. If the artery be considerably widened, the pulsation will be felt over a broader surface than usual. The accompanying delineation is taken from a beautiful example of this condition in a preparation in my own collection. The superficial femoral vein and artery were wounded, aneurismal varix was the result, and the vessels were enlarged as here represented.

Fig. 192.



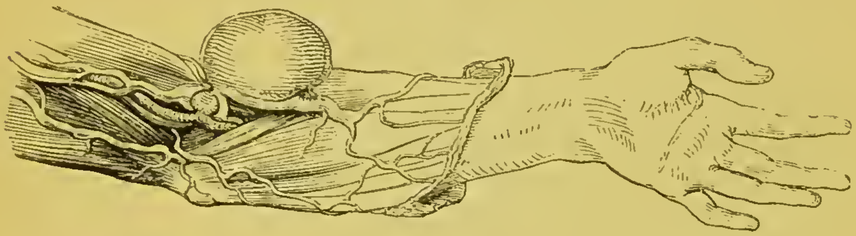
Aneurismal varix, following wound of femoral artery and vein, the former being enlarged to the size of a portion of small intestine. From a preparation in my museum.

The symptoms of aneurismal varix are, feeble pulsation of the artery on the distal side, and a swelled and tortuous condition of the vein, in which a peculiar thrill and bruit are very perceptible. The bruit has been compared by some to the purring of a cat, by some to the prolonged articulation of the letter R, by some to the noise of the fly-wheel of a music-box, and by others to the buzzing of a fly confined in a paper bag. The limb beyond the seat of the disease is usually œdematous and cold, and the skin often presents a cyanotic hue in consequence of the pressure causing congestion, and obstructing the free return of the blood.

With regard to treatment, as this affection is in most cases merely a source of inconvenience, and becomes stationary, palliative treatment, consisting of pressure applied over the whole limb, and more powerfully over the disease, is all that in such circumstances is deemed advisable; but if the symptoms be so urgent as to demand an attempt to accomplish a radical cure, the proper mode of procedure is, by cautious dissection, to expose the artery, and to tie it above and below the opening: this course, however, cannot prudently be adopted if the artery be widened as above described. From what has been stated it will be evident that it is at an early period that an operation is most likely to be useful.

Varicose Aneurism.—The difference between this affection and aneurismal varix is, that in this the communication between the wounded artery and the vein is not direct, but through the intervention of an aneurismal sac. The blood, having escaped through the wound in the artery, passes into the surrounding cellular tissue, which it distends into a sac, and from this sac it is discharged into the vein. The swelling in this instance is formed partly by a circumscribed tumour, and partly by the dilated vein; the former usually continues to increase, as the blood is thrown out more rapidly from the artery than it is transmitted into the vein. The treatment of such cases consists in deligation of the artery both above and below the wounded part.

Fig. 193.



From Liston.

CHAPTER XVI.

DISEASES OF VEINS.

PHLEBITIS.

This term was first applied by M. Breschet, to denote inflammation in the venous tissue. Of inflammation the veins are very susceptible. Phlebitis may be either traumatic or spontaneous, and may exhibit the characters of fibrinous, of limited suppurative, or of diffuse suppurative phlebitis.

FIBRINOUS PHLEBITIS.

Symptoms.—Fibrinous phlebitis—the adhesive phlebitis of Cruveilhier—is the mildest form of this affection, and is characterized by pain, by swelling of the limb below the affected part, by œdema of the surrounding cellular tissue, sometimes, although not invariably, by more or less sympathetic fever of the inflammatory type, and, if the affected vein be superficially situated, by linear hardness and redness in the course of the inflamed vessel. The pain is increased by the dependent posture, by stretching the vessel, and by pressing on the affected part, or on the trunk of the vein leading from it. If the inflammation be slight, there may be little or no swelling or œdema of the limb, or any sympathetic fever. When the affected vein is superficial, the hardness in its course is very distinct; and so is the linear redness, unless the disease be combined with erysipelas, in which case the redness may not be discernible.

State of the parts.—The local changes resulting from this variety of the disease consist in the formation of certain unusual conditions of the contents of the vein, and an alteration of the state of its coats and of the surrounding cellular tissue. There is consolidation of the contents of the vein, whereby its calibre is obstructed; the coagulum is formed partly by an inflammatory product which exudes from the coats of the vein, and partly by coagulation of the blood. Gendrin found, that after insulating a portion of a vein by securing it between two ligatures, and after emptying it of its blood, and exciting inflammation by an irritant injection, a plastic substance filling up the whole calibre of the vessel was formed; hence it seems warrantable to conclude, that in this disease coagulum is partly formed by an exudation from the coats of the vein. In some instances, the plug is evidently formed of concentric layers, and in many, the centre of the coagulum consists of dark coagulated blood. At first the coagulum is but loosely attached to the interior of the vessel, but subsequently becomes more strongly adherent. The coats become red and thick, by plastic effusion into them. The surrounding cellular tissue becomes the subject of serous infiltration, and that in immediate connexion with the vein is often affected with plastic exudation, by which means the vein and the surrounding textures become firmly adherent to each other; and in consequence of this and of the thickened state of the coats, it has been found in some examples, where there has been an opportunity of withdrawing the plug, that the vein had not collapsed, but that its calibre remained open, like that of an artery. Lymph may thus be thrown out around the vein, and so lead to its firm agglutination to surrounding parts; or into the coats, where it will occasion the thickening of the walls of the vein; or into its canal, producing, if it be to a small extent, a coating along the interior of the vein, or if in greater quantity, leading to its entire obstruction. The vein may be ultimately converted into an impervious cord, or absorption may take place, and its natural condition be restored. While the circulation is interrupted through the inflamed vein, it is kept up by the collateral branches which are in a state of unnatural dilatation.

Treatment.—Low diet, the use of aperient and diaphoretic medicines—the free, and, if necessary, the repeated application of leeches, the preservation of the part at perfect rest, and in an attitude favourable for promoting the return of venous blood, and for relaxing the inflamed vein, the employment of warm cataplasms, or of evaporating lotions, or of the local vapour bath, whichever may be most agreeable to the feelings of the patient, constitute the chief parts of the treatment.

LIMITED SUPPURATIVE PHLEBITIS.

The constitutional symptoms are of the same character as in the former affection, being those of sympathetic fever of the inflammatory type; they are, however, more severe.

The local symptoms at first differ from those of fibrinous phlebitis only in being more intense; but afterwards, in one or two situations, a circumscribed swelling is formed, in which fluctuation and the other characters of a small abscess may be detected. Along with the purulent matter there also exists a coagulum both above and below, by which a barrier is presented to the admission of the pus into the general circulation, and the character of limitation, so essential for the safety of the patient, is thus maintained. The purulent matter is, in some instances, though very rarely, found loose in the vein; it is usually enveloped in a thin, fibrinous layer, and is sometimes actually enclosed in the centre of the clot.

The treatment consists in the use of general and local antiphlogistic remedies to an extent proportioned to the severity of the symptoms and the particular circumstances of the case. The whole body should be kept at perfect rest; the affected part being preserved in an attitude favourable for relaxing the inflamed vessel, and promoting the return of venous blood; and warm applications should be diligently employed. When abscess forms, early and free opening should be made, followed by the usual treatment for abscess.

DIFFUSE SUPPURATIVE PHLEBITIS AND PYÆMIA.

Symptoms.—This very dangerous form of the disease sometimes supervenes on the last-mentioned variety, the barrier to the admission of the pus into the circulation giving way in consequence of an increase of the circulation, or of some other cause. In such instances a change is perceptible, both in the local and constitutional symptoms. The local circumscribed swelling subsides, and the constitutional symptoms change very speedily from the inflammatory to the worst form of the typhoid type, the change being usually preceded by shiverings. In most instances, rigors continue to return for some little time; in some, they are severe, attended with a sense of cold, and have a periodical observance like attacks of ague; and in others, they are transient, irregular in their return, unattended with a sense of cold, and not followed by great aggravation of febrile symptoms. In many instances, the characters of the diffuse form are presented from the very commencement of the attack. The local signs in such cases are, pain of a peculiar, oppressive, sickening kind, increased by pressure on the affected vessel, or on its trunk on the cardiac side, by the dependent posture, and by extending the inflamed part; redness, if the affected vessel be superficially situated; diffuse swelling; and œdema. There is great tenderness to the touch along the course of the inflamed vein; but from the absence, both of the plastic effusion and of the coagulum of blood, so essential in suppurative phlebitis for the safety of the patient, there is neither the linear induration, nor the symptom of a knotted cord along the track of the vein. Should death not take place very speedily, gangrene may ensue. The accompanying fever, especially in a more advanced stage, is of a low or typhoid kind, characterized by great prostration of strength, anxiety, irritability, and restlessness, erratic spots of erysipelas in some instances, a sense of weight at the præcordia, a very rapid and feeble pulse, pungent heat of skin, paroxysms of oppressed and hurried breathing, in some cases a peculiar saccharine smell of breath and of the body generally, black sordes on the tongue and teeth, frequent nausea and vomiting, a dull sallow appearance, or a yellowish or even bright icteric tint of the body, purulent deposits, often called disseminated, or scattered, or secondary, or metastatic abscesses in various viscera and organs, great anxiety of countenance, and before death muttering delirium.

Dr. Arnott, in an interesting article in the fifteenth volume of the

"Medico-Chirurgical Transactions," gives the particulars of many fatal cases, and his own conclusions from them. His observations led him to conclude, that there are great differences as to the extent of the inflammation in fatal cases; that pus is found within the veins; that there is a striking resemblance between this form of phlebitis and diseases arising from the inoculation of morbid poison, and that death does not take place from extension of the inflammation to the heart, such extension being a very rare occurrence indeed, as the inflammation usually terminates abruptly where a cross current flows into the main trunk through a collateral branch; but that the contamination of the blood by direct purulent admixture is the cause of the fatal symptoms. The purulent matter not being circumscribed by "fibrinous dykes," as limited phlebitis, finds no barrier to its admission into the circulation.

There are many important sequelæ which present themselves in various parts of the body remote from the seat of the phlebitis, but they are all divisible into two grand classes, the first comprehending such as are referable to the coagulation of the blood in the large venous or arterial trunks, in the central parts of the vascular system, or even in the heart itself; and the second, certain lesions which have their seat in the capillary system. The coagulation of blood consequent on phlebitis has been met with most frequently in the pulmonary artery, and is believed to be the result of the admixture of pus with the blood. It is certain that when pus is mingled with recently drawn blood, coagulation takes place more rapidly and firmly than under ordinary circumstances, and some believe that the coagula found in the larger vessels are caused by pus exerting the same influence on living blood. The sequelæ which have their seat in the capillary system, consist of lesions which have been designated by some, purulent deposits or disseminated abscesses, and by others, "lobular inflammations," and "lobular abscesses." These secondary infiltrations are most commonly found in the lungs and liver, especially in the former; they usually present themselves in the form of deposits disseminated through the parenchyma of those viscera, and differ from abscesses in being neither encysted, nor concentrated into one place. In the chest, the lungs are the organs most frequently affected, but sero-purulent effusions are also met with in the pleuræ, the pericardium, and even on the surface of the heart itself. In the abdomen, the liver is most frequently the seat of such deposits; in the spleen, and in the kidneys, they are very rarely found. The cellular tissue, both subcutaneous and inter-muscular, is very liable to become the seat of purulent deposits, the matter being deposited sometimes as in abscess, and sometimes by infiltration. Such deposits are most common in the cellular tissue around joints. Purulent effusions into the synovial membranes of joints, and even destruction of their cartilages, are well known to practical observers as frequent lesions. Phlebitis is also sometimes attended by inflammation of the membranes of the brain and effusions under them, and even by effusions into the ventricles; but deposits into the substance of the brain, as sequelæ of phlebitis, are extremely rare results. In various instances the eye has been rapidly destroyed; the cornea becoming swollen, and eventually bursting, or becoming totally disorganized. Veins, also, quite remote from those originally diseased, seem liable to secondary suppuration. These are the most common traits of diffuse suppurative phlebitis and of purulent infection, but we seldom find them all present. Sédillot has given the following striking description of this state:—"A patient is attacked by suppuration; when suddenly, either without any premonitory symptom, or some days after a hemorrhage, a diarrhœa, a diffuse inflammation, a phlebitis, an erysipelas, or a painful engorgement of a wound, a more or less violent shivering-fit comes on. Frequently there is observed a general trembling, chattering of the teeth, a drawing in of the limbs towards the trunk, and a morbid diminution of temperature of the skin; speech is difficult, the words uttered being short and interrupted; the eyes are hollow, and the features contracted; the countenance is of a leaden or yellowish colour; the respiration frequent; the pulse small, soft, and rapid, and an instinctive sense of great peril is presented. The shivering ceases after a period varying from ten to forty-five minutes; the warmth of surface returns, and a slight transpiration is established. Erratic shiverings, however, return, and not unfrequently at the same hours as in the first instance; the wound dries up, or the suppuration becomes greyish and fœtid; the surfaces of wounds assume a withered, flabby aspect; the bones become denuded, and ill-conditioned ulcers arise or extend. The patient seems as if exhausted by fatigue, and plunged into a kind of *coma vigil*, with occasional delirium, or into a deep stupor; the inspirations are made laboriously, and become more and more accelerated, so that thirty, forty, and fifty per minute are counted; the breath exhales a purulent odour; subcrepitating *râles* are heard in the chest, the air also not seeming to reach the minuter bronchial ramifications; the skin becomes daily more earthy, yellowish, generally as if jaundiced; articular pains, with swelling and intro-synovial effusion, manifest themselves successively in the various joints; one or both of the calves may become the seat of considerable swelling, attended with great suffering; and sometimes severe stitches in the side of the chest force cries from the patient. The tongue becomes dry; the lips and teeth are covered with a fuliginous paste; the belly is tender, the pulse tremulous and rapid, subsultus agitates the limbs, the eye looks dull, the cornea has lost its polish, the bladder is no longer emptied, partial paralyses may manifest themselves, the voice is lost, and the patient dies from the fourth to the eighth day in a state of extreme emaciation, and after a prolonged struggle."

Causes.—Pyæmia is never an idiopathic or primary affection; but either occurs subsequently to diffuse inflammation of veins, erysipelas, diffused abscess, wounds or injuries of veins, bones, or joints, to the suppurative stage of some low form of inflammation, or in connexion with the puerperal state, when it is probably the result of suppurative phlebitis. Operations or proceedings of any kind capable of inducing phlebitis, may give rise to pyæmia. Amputations, operations on bones, removal of hemorrhoids, are well known to have frequently proved fatal by pyæmia. If phlebitis be induced in any way, and if in consequence of loss of blood, shock, inadequate food, or previous disease, or if the blood be contaminated by breathing impure air, or by any defect of hygienic arrangement, or if, owing to peculiarity of season, diseases of a low type prevail, the phlebitis, whatever way induced, will be apt to assume the spreading or erysipelatous character, and the patient will then be in danger of falling a victim to pyæmia. These circumstances furnish explanation of many well-known phenomena, and suggest strongly the importance of precautions, the neglect of which often leads to distressing results.

Pyæmia is the term now generally employed to denote this remarkable and usually fatal constitutional affection, supposed to be dependent on the admission of pus into the circulating blood. It is a corruption of pyohemia, first applied to this disease by Piorry, and is synonymous with ichoremia, a term recently introduced into pathology. At one time, the terms diffuse suppurative phlebitis and pyæmia were used as synonymous; but most authors now employ the expression, diffuse suppurative phlebitis, to denote the local primary condition, and pyæmia, to comprehend the whole constitutional symptoms and morbid conditions caused by the blood being contaminated by pus.

Morbid Changes.—That the blood undergoes important changes in this disease must be admitted. When drawn from the body, it is dark-coloured, and forms a loose coagulum, and yields a turbid-looking serum. By the aid of the microscope it is seen to contain large quantities of corpuscles, having a complete resemblance to pus-cells, and these bodies are regarded as constituting the essential element of this disease. In some instances, these bodies have an exact resemblance to pus-cells; in others, they resemble more the granulation or exudation-cells found in chronic abscesses occurring in cachectic constitutions; while some of the bodies have such an exact similitude to the white corpuscles of the blood, that the most practised eye fails to perceive a difference. Viewing these bodies as products of inflammation, there is considerable difference of opinion as to how they are introduced into the blood. The belief still most generally entertained is that which has been advocated by Hunter, Arnott, Berard, Cruveilhier, and many others, and has already been stated—namely, that the pus is the result of phlebitis. The antecedent existence of phlebitis in the great majority of cases must be admitted, and a most searching examination of the state of the veins would be necessary, before drawing the conclusion that phlebitis is not the source of the purulent contamination of the blood.

The opinion was at one time entertained, that pus in substance, pus unchanged, would be absorbed by the veins. This opinion, that pus may pass bodily into the veins without any change in its composition, is now abandoned ; but a doctrine that certain kinds of pus yield a poison which enters the circulation, contaminates the blood, and gives rise to the symptoms and morbid appearances in pyæmia, has been advocated by some excellent pathologists, and by none more ably than by Professor Bennett. Another belief is, that "instead of being formed from without, and absorbed and poured into the blood, they are actually generated in that fluid itself, during its passage through the unhealthy inflamed tissue, not, however, by any conversion of the blood-globules into a lymph or pus-cell, but as a consequence of those changes which we know, by their effects, to be impressed upon blood by circulating through inflamed tissues, but with the precise nature of which we are still unacquainted." Pus or some similar matter having been introduced into the circulation, gives rise to purulent collections much more frequently in some parts than in others. Sédillot found that in 100 cases of pyæmia, the lungs were affected in 99 ; the liver and spleen in 1 of 12 ; the muscles in 1 of 15 ; and the heart in 1 of 20. A question of great interest is, How does pus commingled with the blood give rise to these purulent collections? "Some have maintained that the pus in substance was carried to the parts in which it is found, and there simply deposited. Others were of opinion that the tainted blood created in the system a general tendency to inflammation, which was developed in several places simultaneously. Neither of these suppositions was quite true, neither of them quite false. Foreign substances entering the blood, and failing to pass out of it again through the natural emunctories of the body, are liable to be stopped when they arrive at the first network of capillary vessels that lie in their course. Now the blood, circulating in the veins, reaches (much of it at least) in each of its circuits, two such great networks, the hepatic and the pulmonary. Through the pulmonary network all the blood must pass, through the hepatic some of it ; and it is there, in the capillary tissue of these organs, that particles of pus, and other material substances, foreign to the blood, and incapable of being eliminated with the customary excretions, are apt to stick, or be entangled, and to excite inflammation. Some of them, however, in general, pass on, and arriving at the left side of the heart, are transmitted, with the arterial blood, to various parts of the body, there to exercise a similar deleterious influence.

"Such was, and is, the theory ; and it has been tested and confirmed by direct experiment. Inasmuch as the conveyance of the pus cannot be traced by the eye, nor the manner of its being collected into an abscess demonstrated, except by inference, Cruveilhier introduced *quicksilver* into the veins of animals; a metal which is liquid, and divisible into very minute particles, and which exerts no chemical agency upon the vital fluid. When the mercury was inserted into the veins which concur to form the vena portæ, the whole, or the greater part of it, was arrested in the liver. In that organ, the animal being killed a certain time after the introduction of the metal, small, roundish, red spots were always discoverable, which passed gradually into little abscesses surrounded by a halo of inflammatory redness; and in the centre of each red spot, and of each abscess, lay a minute globule of mercury. A few similar points of suppuration were usually to be seen in the lungs also. But when the quicksilver was put into the blood in its direct course towards the vena cava, then it was in the lungs that these points were either exclusively detected, or at any rate most numerous." Such are the views of our best authors, and I regret that my space will not allow me to give those of Lee, Tessier, Bonnet, Darcet, Millington and others, on this interesting subject.

Treatment.—The only cases, in which I have seen benefit from treatment, were those in which the patient took opium three times a-day; wine, brandy, and egg, the wine and brandy in large quantities; and 25 drops of the tincture of the muriate of iron every four hours.

VARICOSE VEINS.

CAUSES, ANATOMICAL CHARACTERS, AND TREATMENT.

Varix, which has been defined to mean, "a vein preternaturally dilated without the dilatation being instituted to answer any good purpose in the animal economy," may originate in any permanent obstruction to the venous return, as, for instance, in pressure on the venous trunks above, induced by distended rectum, by diseased liver, by the gravid uterus, by aneurismal or other tumours; or it may arise from some obstacle to the passage of the blood through the heart or lungs, or from relaxation or weakness of the coats themselves. According to some authorities, it arises more frequently from weakness of the veins than from any other cause. In some examples, obstruction from inflammation in the vein itself has been supposed to give rise to the disease; and, in some, violent and sudden muscular exertion has occasioned it.

Varices occur principally in three situations, namely, in the lower extremities, in the spermatic cord, when the disease is termed varicocele; and about the lower part of the rectum, constituting the disease called hemorrhoids, or piles. Varicose veins occur occasionally in other parts of the body, various examples of which are recorded, and in most of them the disease could be clearly traced to some obstruction to the return of the blood by the venous trunks leading from the affected part. It is to varices in the lower extremity that the following observations are intended to apply. It is an extremely rare thing for the deep-seated veins to be the subjects of this disease, in consequence of their coats being supported by surrounding textures. The vessels which afford examples are the vena sâphena interna, and the vena saphena externa; but principally the former, the branches of which about the ankle and inner part of the leg are often affected. These veins are so situated that their coats receive little support from surrounding structures to aid them in resisting the dilatation caused by accumulation of blood within them.

The calibre of a vein affected with this disease is enlarged. The vessel is not only dilated, the dilatation either being nearly equable, or presenting sacculated or knotty protuberances on various parts, but it is also elongated, and thereby becomes tortuous. In many instances the vein exhibits a very irregular aspect, being equably wide at some parts, comparatively narrow at others, and at others dilated into irregularly shaped cavities. The enlargement may be accompanied either by increased or diminished thickness of the coats, or by both states at different points. The state of the coats, however, is not the same in the different forms of varix, nor in the same form at different periods. Hassie makes the following observations on this subject. "In persons affected with a morbid preponderance of the venous system, we first of all observe an undue prominence of the veins of the skin. These appear in dense nets of branches, remarkable for their diffuse distribution, and are generally turgid with blood, or liable to become so from the slightest mechanical or dynamical causes—like what, under ordinary circumstances, would be the effect of violent and prolonged muscular exertion. In this condition of the veins their coats have not undergone any absolute change, being everywhere proportionate to the width of the calibre; the vessels are not more than usually tortuous, and cannot as yet be called morbidly altered: after a while, however, the veins become permanently dilated, an occurrence more frequent in elderly than in young persons. This is brought about by a reinforcement of the fibrous texture of their external coat, in the shape of an accession of conspicuous transverse fibres. Meanwhile the internal membrane remains unchanged in structure, merely displaying numerous lines or superficial furrows running lengthwise, and the vessel still maintains its natural course, not assuming a more sinuous, but rather, if anything, a straighter direction than before. It does not collapse when cut through, but remains patent, and is distinguishable from the arteries by its colour, which is of the same pale red as the fibro-felt-like texture constituting the normal external membrane of a vein. The valves remain unaltered. In this condition the saphena is frequently found in old persons; so likewise are certain branches of the vesical plexus, whilst other branches manifest still farther changes. In the greater number of instances, however, the external membrane of the vein is not thickened, but, along with the other membrane, undergoes considerable attenuation, in proportion as the vein becomes more and more dilated. Conformably with their irregular disposition, the intermediate fibres give way unequally, allowing the internal membrane to jut out in sac-like protrusions, and to establish so many irregular, constricted, pear-shaped, and often in appearance, pediculated tumours. At the commencement of some of the smaller branches the membrane thus forms pouch-like dilatations, or forces itself between the longitudinal fibres of the external membrane in lengthy protuberances, which exceed in circumference that of the vein in its natural state; or, it may, perhaps, distend cylindrically and pretty equably for a considerable length the intermediate fibres before alluded to. Meanwhile the valves become attenuated, and pulled asunder transversely, so as to be rendered useless: in many instances they become partially or wholly obliterated, and are torn into shreds, or destroyed as far as their free border, which then runs across the diameter of the vessel like a filament or band, attached by the two extremities to the internal membrane. The veins now appear elongated, and their course very tortuous."

Varicose veins at first contain blood in a fluid state; but an alteration of the contents, which frequently occurs, is the coagulation of the blood, whereby the vessels become obstructed. The formation of coagula is considered to be a product of inflammation, varicose veins being liable to be attacked by that process, and, as was stated in the description of the anatomical characters of some of the forms of phlebitis, coagulation of the blood is an early result of inflammation when it attacks the venous tissues.

In many instances, varicose veins create little inconvenience; in others, they cause much discomfort and annoyance by pain, fulness, and weakness of the affected part, aggravated by exercise and the erect posture. The following results are not unfrequent—phlebitis, hemorrhage, certain conditions of cellular tissue, varicose ulcers, and inflammation of the skin.

Inflammation of the vein may be of a slight grade, giving rise to coagulation of its contents; or it may affect both vein and cellular tissue, and, reaching the suppurative grade, give rise to a small abscess in the first instance, and afterwards to varicose ulcer, although this is not, as will hereafter be stated, the mode in which the form of ulcer denominated varicose usually originates. Phlebitis, when a consequence of varicose veins, usually assumes the form of fibrinous phlebitis, producing destruction, or of limited suppurative phlebitis, but very rarely indeed that of the diffuse suppurative variety. In some instances, the vein and superficial parts have become so greatly attenuated as to produce bursting of the vessel, followed by serious, and occasionally even by fatal hemorrhage. The valves being rendered incapable of performing their office, the pressure of the column of blood may give rise either to inflammation, or to increase of dilatation, and eventually to hemorrhage, which, as there is no obstacle to the descent of the blood from the trunks of the veins, may be excessive.

Other conditions of frequent occurrence are, œdema of the cellular tissue, merely from obstruction of circulation; or œdematous effusion, as a product of a low grade of inflammation of the cellular tissue, when the substance effused is of a less fluid character than when the œdema arises from the obstruction to free circulation; or, if the inflammation be of a rather higher grade, the cellular tissue may be consolidated by effusion of lymph. Such are the more frequent conditions of the cellular tissue surrounding varices in general; but in that variety which constitutes a form of hemorrhoids, a different state of cellular tissue is found, as will be stated in another section.

Varicose ulcers are frequent consequences of varices, and they arise either from limited suppurative phlebitis ending in abscess, and the formation of an ulcer, or from inflammation of the skin, which either cracks or has a scab formed over an irritated and inflamed part, where an ulcer ultimately forms.

Treatment.—The treatment of varicose veins is either *palliative* or *radical:* the former has now almost entirely superseded the latter, and in the opinion of the writer ought always to be preferred, except when the disease endangers the life of the patient.

Palliative Treatment.—One of the most important indications, except in the case of pregnancy, is to remove, if possible, the exciting cause; and for that purpose remedies adapted to the particular circumstances of the case ought to be prescribed. In all cases, it is advisable to preserve the bowels in a regular state—to enjoin the use of light nourishment, but with abstinence from liquids—to direct the patient not to remain long in the erect posture—to remove from time to time from the weakened vessels the weight of the superincumbent column of blood—to recommend that the recumbent posture be frequently assumed in order to favour the return of blood, and that violent or long continued muscular exertion be avoided; and, except in the case of phlebitis, to support the weakened vessels by means of pressure. For this last purpose, a common roller, or a starched bandage, or elastic bandages of India-rubber, are sometimes used; but the two most convenient appliances, as affording a very equal pressure, are an elastic stocking, or an elastic bandage of stocking web. The pressure should be sufficient to afford support, and to diminish the size of the dilated veins, but not to produce any undue constriction of the limb.

If the varicose veins be affected with phlebitis, pressure will be extremely injurious. In such cases, the treatment consists in preserving the whole body at perfect rest,—keeping the affected limb in the horizontal posture,—applying leeches in the neighbourhood of the vein,—employing either cold lotions or warm applications, as may be most grateful to the feelings of the patient; together with the strict observance of antiphlogistic regimen.

Radical Treatment.—It would answer no useful purpose to explain all the methods which have been adopted for effecting a radical cure.

Some of the methods are—1. Puncturing the vein, first proposed by Hippocrates. 2. Excision, originally suggested by Celsus. 3. Tying the vein, anciently proposed by Paulus Ægineta, revived by Home, and afterwards very properly abandoned. 4. Cutting through the vein by subcutaneous section, as practised by Brodie. 5. Cauterization, of which proceeding there are several varieties, one of which recommended by Seatin, Bonnet, and others, consists in making a series of small eschars in the skin by means of potassa fusa or the chloride of zinc—the object aimed at being obliteration by adhesion of portions of the vein. 6. Pressure by means of a needle and twisted suture, in order to effect obliteration of the vein, has been practised with considerable success by M. Velpeau. He introduces a needle underneath the vein, and applies a twisted suture round its ends, and if considerable inflammation supervenes, he withdraws it in a few days; his object being to induce sufficient inflammation to reach the fibrinous grade, and thereby to cause occlusion; but if little inflammation result, he allows the needle to eat its way through. Few serious consequences have resulted from this operation; and it is preferable to other modes for attempting obliteration of varicose veins. An excellent addition to this mode of treatment is the suggestion of Mr. Lee, to divide by subcutaneous section the portion of vein between the pins after coagulation has taken place. Obliteration of the vein is thereby ensured.

PHLEBOLITHES OR VEINSTONES.

These concretions have been found in dilated veins in the neck, extremities, in the veins of the spermatic cord, scrotum, bladder, and prostate gland. They are formed by the degeneration of coagula, and are composed principally of phosphate of lime and magnesia. When in an accessible situation, removal by excision is the only useful proceeding.

ENTRANCE OF AIR INTO VEINS.

Wepfer, Vander-Heyden, and other physiologists knew, long ago, the disastrous results of the introduction of air into veins; but this interesting subject does not seem to have excited much attention until Morgagni, Valsalva, Bichat, Nysten, and Magendie made the injection of air into the veins of animals a subject of experiment. Bichat stated that the introduction of a single bubble kills the animal with the rapidity of lightning: but Nysten and others have clearly shown that this is erroneous, and that while a small quantity, if rapidly injected into the jugular vein of a dog, causes almost instantaneous death, if injected slowly, it only causes great distress, but does not destroy life; and that two or three cubic inches will not destroy life or produce serious inconvenience, provided it be introduced very slowly and gradually; the blood appearing in the last-mentioned mode of introduction to combine with or to dissolve and carry away the air. In the practice of surgery, we do not meet with demonstrations of the effects of the forcible injection; but unfortunately, the fatal results of the accidental spontaneous admission of air have been too frequently demonstrated. This accident first occurred in 1818, in the experience of M. Beauchesne, in an operation for the removal of a tumour from the lower part of the neck. It was necessary to disarticulate and raise up the clavicle; and while this was being effected, the patient became faint, exclaimed "I am dying," and expired in less than a quarter of an hour. Dissection revealed a small wound in the internal jugular vein at its junction with the subclavian, and the entrance of air through that wound caused the fatal result. The accident has since happened in the practice of Mirault, Clemot, Roux, Magendie, Castara, Dupuytren, Delpech, Bégin, B. Cooper, Erichsen, Warren, Mott, Stevens, and others, both in Europe and America. The occurrence of this accident in the human subject led to the appointment of a commission by the French Academy to investigate the subject of the entrance of air into veins; and the labours of Magendie, Amussat, Wattmann, and Cormack have greatly contributed to give clearness to our views on this subject.

Symptoms.—The local symptoms are a peculiar sound of a hissing, gurgling, lapping, or sucking character, produced by the entrance of the air, and the appearance of bubbles about the wound in the vein. The patient is suddenly seized with the constitutional symptoms; of which the most remarkable are great faintness, a horrible feeling of terror and impending danger, inducing him in general to exclaim that he is dying, a convulsive struggle, and great oppression in breathing. A "churning noise is heard in the heart, synchronous with the ventricular systole;" and the hand applied to the chest "perceives at the same time a peculiar bubbling, thrilling, rasping sensation, occasioned by the air and blood being, as it were, whipped together" within the ventricle. The heart's action becomes extremely feeble, and the pulse almost imperceptible. The symptoms may pass off, and the patient may rally, if only a small quantity of air has entered; but more copious entrance speedily causes death without convulsions, as if by simple syncope; but, "in most cases, it is a struggle to the last."

The period at which death occurs varies.—In some cases, life is destroyed almost with the rapidity of lightning; in others, the period varies from a few minutes to several hours. In the majority of patients who have survived, several hours have elapsed before consciousness and strength were restored. Some patients—as, for example, those of Roux and Malgaigne—recovered from the immediate effects of the accident, and died afterwards of pneumonia.

Mode of death.—For some time after respiration has ceased, the heart continues to beat; it is the *ultimum moriens*, in this instance. It might be supposed that the air distending the heart would clog its action; and that death would begin there. But it is not so. The mode of death would seem to be the following:—The blood becoming mingled with air, assumes a frothy character in the right ventricle, and thence is sent through the pulmonary artery; but is more or less arrested in the pulmonic capillaries, or terminal branches of the pulmonary artery, in consequence of the right ventricle being unable to overcome the mechanical obstacle presented by air bubbles in these vessels. The quantity of blood transmitted through the lungs, for the systemic circulation, grows less and less, according to the increase of obstruction and arrest in the capillaries of the lungs. The supply to the head is inadequate to afford due stimulus to the nervous centre, and syncope results. If circulation be not restored, the syncope continues; the respiratory movements then cease, and life becomes extinct; the heart last failing in its action, from want of its necessary stimulus, the blood.

The cause.—Owing to the tendency to the formation of a vacuum in the pericardium during inspiration, there is, during that process, a suction action, called by some "venous inspiration," in the veins within and near the thorax, extending to a limited extent only, and ceasing where the coats of the veins collapse. The space in which this suction action exists is that in which venous flux and reflux are perceptible. It may be said to be confined to the neck and axilla; and if a vein be wounded in this situation, there is a risk of air obtaining entrance; and hence, in reference to this accident, that the neck and axilla constitute the dangerous region—the lower part of the neck more particularly deserving that appellation. Accordingly we find that the recorded instances of this accident took place in consequence of veins being wounded in that region. In the patients of Beauchesne, Bégin, Mirault, Ulrick, and in a case of attempted suicide, recorded by Erichsen, the internal jugular vein was wounded; in Malgaigne's patient it was the external jugular vein; in a case by Delpech, it was the axillary vein; in one by Mott, it was the facial vein; in a case by Warren, it was the subscapular vein; in one by Castara, it was a vein which opened into the subscapular, while the tumour was being raised up; and in one by Dupuytren, it was a large vein in the neck, communicating with the jugular, that was cut at the last stroke of the knife, whilst the tumour was being forcibly drawn up. The vein was found adherent to a corner of the wound, and remained open.

Circumstances favouring the accident.—1. The site of the wounded vein being in the dangerous regions. 2. Canalization of a vein, caused by its coats being thickened by morbid deposits, by being adherent to condensed, consolidated surrounding textures, or by spasmodic contraction of muscles : any of these three conditions may have a canalizing effect. 3. Traction on the vein. 4. A stretched position of the part operated upon. 5. The form of the wound. 6. The position of the vein in the wound ; a vein cut in the corner of a wound being apt to gape, as Dupuytren's case demonstrated. 7. Deep inspiration.

Treatment.—In operations in dangerous localities, preventive treatment, consisting of pressure on the cardiac side of the wound by the fingers of an intelligent assistant, maintenance of a relaxed position of the part operated upon, and the prevention of stretching of veins, should be carefully attended to. It is also important to avoid as much as possible cutting veins of any considerable size, and especially any vein in which the venous pulse is perceptible. For reasons formerly stated, it is also desirable that the inspiration should be feeble, and this is effectually secured by the employment of anæsthesia. For preventing deep inspiration, some have recommended that the chest should be firmly bandaged during the operation; but I concur with those who on principle object to this proceeding, and especially if the patient is to be brought into a state of anæsthesia. Curative treatment should have for its object the fulfilment of these indications :— 1. To maintain an adequate supply of blood to the brain, so as to ward off death by syncope. With this view the patient should be placed recumbent, with the head low, and pressure should be made on the axillary and femoral arteries, so as to direct as much as possible of the circulating current to the brain. 2. To maintain the action of the heart by artificial respiration, and friction at the præcordial region. 3. To promote the removal of obstruction of the capillaries of the lungs ; for which purpose also, artificial respiration will be the more useful means. 4. After recovering from the immediate effects of the accident, to guard against the occurrence of inflammation of the lungs, which experience has shown is apt to ensue.

CHAPTER XVII.

HERNIA.

Abdominal herniæ, or ruptures, are usually divided, if their condition is taken as the basis of arrangement, into *three* classes, namely, *reducible, irreducible,* and *strangulated;* or, if they are arranged according to situation, into four, namely, *inguinal, femoral, umbilical,* and *ventral.* It will help to a clearer understanding of this subject, if we consider these two divisions separately, giving under the first, the general doctrines of hernia, and under the second, the different forms of hernia, as they present themselves in the living body.

REDUCIBLE HERNIA.

Definition.—A hernia is reducible, when it can be easily returned into the cavity of the abdomen.

Symptoms.—In reducible hernia there is a swelling, which presents the following characters :—It is unattended with heat, discoloration, tenderness, pain, or even uneasiness, except when the tumour first takes place, at which period an uneasy sensation of weakness in the parts is in some instances complained of. The swelling begins from above, and gradually descends ; it is brought on by the erect posture, coughing, sneezing, pressing on the abdomen, or by any exertion of the abdominal muscles or diaphragm ; and it disappears in the recumbent posture, or when gentle pressure is applied. During coughing it becomes larger and tense, and communicates a sudden impulse to the hand of the examiner. These symptoms may be observed in every reducible tumour ; but there are others, which, although more variable, characterize a hernial tumour, and when present, furnish information regarding its contents. If the swelling be elastic, uniform, and compressible, and if its return be sudden and attended with a peculiar gurgling noise—the gargouillement of the French writers—there can be no doubt that the hernia is formed of intestine. The smooth surface of the intestine makes its return easy and sudden, and the mixture of air with other intestinal contents gives rise to the peculiar gurgling sound. If the swelling be more solid and uneven—if it feel heavy to the patient—if it be doughy to the touch, and receive an impression from the fingers of the examiner, and if its return be gradual and unattended with any peculiar sound, there can be no doubt of its being an omental hernia. When omentum forms the hernia, its surface becomes moulded by the surrounding parts, and in consequence, its return into the abdomen is gradual. If a portion of the swelling be elastic, and return suddenly with a gurgling noise; and if the remaining part be doughy and its return more gradual and less easily accomplished, the hernia is in all probability formed of intestine and omentum. These discriminating symptoms, when well marked, as they usually are in hernia of short standing and moderate size, furnish very satisfactory information regarding the contents of the hernia; but if the hernia be small, it is often difficult and even impossible to arrive at a decided conclusion as to its contents; and if it be of long standing, there is frequently the same difficulty, since the thickening of the hernial sac, and the adhesion of the parts of the hernia to each other, and change of structure, diminish the accuracy of any nice discrimination by the touch. When the hernia is formed of intestine alone, it is called an Enterocele; when of omentum alone, an Epiplocele; when of both intestine and omentum, an Entero-epiplocele; and when of a redundant portion of bowel in the form of a diverticulum, a Hernia Litrica.

Treatment.—The treatment of reducible hernia consists in returning it into the abdomen, and preventing its recurrence by the pressure of a truss. A reducible hernia generally goes up of itself, when the patient is placed in the horizontal posture, and more especially if the thigh on the affected side be brought a little upwards and inwards, so as to relax the parts about the hernia. When it does not return of itself, it may be replaced by certain manual proceedings, technically called the operation of the taxis; the manner of performing which varies in some respects, according to the situation of the hernia, as will be explained hereafter. Pressure by means of a truss is employed for the purpose of preventing a recurrence of the hernia. While the patient requires to use a truss, the treatment is palliative or preventive; when it has induced such a change as to prevent any tendency to a recurrence of the hernia, the cure is said to be complete or radical. There is no period of life at which a truss may not be used. At one time it was supposed that it could not be applied to a child; but it is now ascertained that if a truss be sufficiently weak, it may be worn by the youngest children without inconvenience; and as a complete or radical cure is readily produced in early life, it is of the greatest importance that the application of a truss should not be delayed. The only condition of parts, in early life, which forbids the use of the truss is the testicle not having descended through the inguinal canal. The pressure and thickening of parts, under these circumstances, might present an obstacle to the descent of the testicle, and cause its permanent retention in the abdomen; but fortunately this condition of the testicle is of rare occurrence. If, however, it should present itself in a case of reducible hernia, the application of the truss ought to be delayed until the testicle has made its way into the scrotum.

In regard to the use of a truss, the following points are deserving of consideration :—

1. *The ways in which a truss produces a radical cure.*—If a hernia has been very suddenly produced, if it be very small, and if it be very quickly returned, the hernial sac may either return with the hernia, or be gradually drawn back into the cavity of the abdomen. After the return of the sac, the pressure of a truss sometimes produces sufficient diminution of the opening by contraction, effusion of lymph, and consequent joining of the surfaces, to prevent any future protrusion of sac or hernia. This kind of cure, however, in which the sac returns, and its future protrusion is prevented by the diminution of the opening, is only to be looked for in small herniæ of short standing. If a hernia be of considerable size, and more especially if it be also of long standing, the distension of the hernial sac, and the pressure of the surrounding parts excite a degree of inflammation by which those parts and the sac become adherent to each other, so that the sac cannot be returned into the abdomen, and the kind of complete cure already described cannot take place. 2. After the return of a hernia, the sac being empty, contracts by its own elasticity, in accordance with the general law, that membranous parts accommodate themselves to the state of their contents. This kind of closure of the hernial sac is analogous to the contraction of the tubular portion of the peritoneum, which exists within the inguinal canal for some time after the descent of the testicle. A truss, by approximating to each other the sides of the hernial sac,-may assist the natural elasticity in closing up its neck, and in bringing about a radical cure. 3. Occasionally the wearing of a truss for a long time produces thickening of the neck of the sac, or of the cellular tissue surrounding it, or of both, and thus interrupts the communication between the cavities of the abdomen, and the hernial sac. 4. The pressure of a truss often excites adhesive inflammation in the sac, by which its opposite sides become joined together by coagulable lymph, and a recurrence of hernia is prevented. 5. Paré, Arnaud, and others record cases in which complete cures were effected by the firm adhesion of the formerly protruded parts to the peritoneum lining the abdomen around the mouth of the hernial sac ; and as in these cases trusses had been worn, it was believed that the pressure gave rise to inflammation in the neck of the sac, and that this inflammation, having extended to the membrane lining the cavity of the abdomen, produced the adhesions. 6. Absorption of the neck and part of the body of the sac sometimes produces radical cure. I lately had an opportunity of demonstrating this condition of parts to the students at this School of Medicine, in the body of a person who had worn a truss for many years for the cure of a reducible hernia.

2. *The situation to which the truss should be applied.*—Since the immediate object which the surgeon desires to accomplish by the

pressure of the truss is, to prevent a return of the hernia, and the ultimate object, to induce some of the various changes already described by which the tendency to its recurrence may be removed, it must be evident that the precise part to which the pressure should be applied is, that where the hernia first quits the abdomen.

3. *The length of time a truss should be worn.*—As the prospect of a complete cure is very different at the different periods of life, it being almost a matter of certainty in young persons, occasionally met with in adults, and not to be expected in elderly persons, there will be a corresponding difference in the length of time that the truss must be worn, as well as in the object of wearing it; the object being at one period merely preventive or palliative treatment, at others palliative treatment and radical cure. In young persons a complete cure is often effected in less than twelve months, in adults seldom under two years at least, and in old persons it is not to be expected. In regard to the time a truss should be worn, Sir Astley Cooper remarks, "You will be asked by the patient when you have applied the truss, how long he is to wear it; tell him to wear it at least two years. He will then ask you whether he is likely to be cured at the end of that time; your answer must be that this must depend upon his age. A young person is generally cured at the end of two years, but it will be advisable for him to continue to use the truss for three years. If the person be not young, there is not much hope of effecting the cure of hernia by wearing a truss."

The truss should be constantly worn, not only during the day but also during the night, because although the probability of a recurrence of the hernia is by no means great in the recumbent posture, yet it might be induced by a cough, or any sudden change in the posture of the body in bed, and then the cure would require to be commenced anew from that period.

4. *The chief sources of inconvenience from wearing a truss.*—The chief inconveniences from the use of a truss arise for the most part from its being too strong, or from the pad being placed in an improper situation; hence the necessity of selecting a truss of the proper strength and length for a patient. It should be strong enough to prevent any recurrence of the hernia, but not to cause any painful irritation of the soft parts. Labouring people and those who are required to use great bodily exertion need stronger trusses than others. The length of the truss is also a matter of great importance, not only that the pad may rest on the precise spot where the hernia came out from the abdomen, but also that it may not rest upon the side of the pubes, the result of which is apt to be irritation of the soft parts from pressure between the bone and the truss, and swelling of the testicle from compression of the veins of the cord.

For accomplishing a radical cure, various other proceedings have been adopted, besides the use of a truss. Some of these were, exposure of the sac, and the application of a ligature to its neck; opening the sac, and applying irritants, in the hope of accomplishing destruction; cutting out the sac, and, in scrotal hernia, removal of the testicles along with it; which practice, Dionis informs us, became so common in the seventeenth century, that "an itinerant operator was in the habit of feeding his dogs with the organs which he thus removed." It is fortunate for mankind that in these milder times of surgery no one would ever think of such methods of treatment. The operations of Guérin, Bonnet, Pancoast, and Gerdy have not gained the approval of any surgical authority in these islands. Guérin's operation consists in scarifying the neck of the sac by a small bistoury introduced subcutaneously, and endeavouring to promote union by the pressure of a truss. Bonnet's operation, called acupuncturation, consists in transfixing the sac with many pins, permitting them to remain for a considerable time, and in applying compression in the intervals between them. Pancoast's operation consists in returning the hernia into the abdomen, injecting about a drachm of the tincture of iodine into the sac, applying a firm compress over the internal aperture, and in keeping the sides of the sac in close apposition by means of a truss. In Gerdy's operation the common integument is pushed up into the neck of the sac, and confined in that situation by means of two points of interrupted suture, the invaginated portion of the integument is denuded of its cuticle by the application of spirits of ammonia, and adhesion of the opposed surfaces of sac and of common integument to each other respectively is sought to be obtained. To Wützer of Bonn belongs the merit of devising a safe and successful operation for effecting a radical cure; to Spencer Wells belongs the merit of introducing this operation into England; and it may be stated that Wützer's operation performed with his original instrument somewhat improved, and Wood's operation, are two proceedings deservedly regarded as great improvements in practical surgery.

Wützer's instrument, as improved by Rothmund of Munich, Mr. Spencer Wells, and Mr. Redfern Davies, consists of a roundish wooden plug, made to expand like a glove-stretcher, if required to do so, to fill the canal with a wooden pad or cover to match, and within the plug a needle concealed, but capable of being pressed through the integument, and passed through a slit in the wooden pad. The cover or pad is of the same breadth and length as the plug or cylinder, and screwed to it by a screw. By means of a movable handle the needle can be pressed through the opening near the extremity of the plug. The bowels and bladder having been emptied, the hair having been removed, the patient placed in the attitude for the taxis, and the protruded parts returned, the surgeon invaginates the sac and its coverings by pushing up his forefinge with the palmar aspect forward, being very careful that the finger is not in front of the tendon of the external oblique muscle, but within the canal, and carried up to the internal aperture. The plug, well oiled, is then carried along the *cul-de-sac* in front of the finger, which is withdrawn as the plug is being sent up. In this step of the operation, as Wells directs, the surgeon must make sure that the plug is within the canal, that it is behind and not in front of the external oblique tendon, and that its extremity is lodged in the internal aperture. The needle or needles should then be pushed onwards through the skin by means of the handle, the cover should be adjusted by means of the screw, the needles should be fixed in their places by screws, their points removed, knobs put on them, the cover screwed down moderately tightly, and the handle of the instrument removed. Care must be taken that the pressure on the invaginated portion between the plug and cover is not too great, lest sloughing should be produced. In five or six days some suppuration is seen about the needles, and a serous fluid begins to ooze from the invaginated integument. The instrument should then be removed. By gently pulling the skin of the scrotum it will be seen whether or not adhesions have taken place. If the invaginated portion be loose, the instrument must be replaced for two or three days; and during the whole period of its use the pressure must be regulated by the tolerance of the patient. About six to eight days may be allowed for the use of the instrument; from seven to fourteen more for cicatrization; after which a very slight truss with soft pad should be used. From this description it is to be hoped that this very simple, safe, and very successful operation may be clearly understood.

Wood's operation. This is also an admirable operation, and may be performed thus:—An incision about half an inch in length is made through the skin of the scrotum, over the spermatic cord, an inch and a half below the pubic spine. The skin is then separated, by means of a small tenotomy knife, from the subjacent fascia in a circle around this incision, about two inches in diameter. Next, the finger is introduced into the wound, and made to pass into the inguinal canal. The finger then searches for the arched border of the internal oblique muscle, and is carried behind it towards the linea alba. Then a curved needle, with its point protected by a tube, is carried up along the concavity of the finger, and made to perforate the conjoined tendon close to the internal ring, and to perforate the skin; but the skin, before perforation, is to be drawn upwards and inwards, so that the outward puncture will be, when the skin is restored to its natural situation, lower and more external than the point where the conjoined tendon is perforated. A thread is now put through the eye of the needle, and the needle withdrawn, leaving one *end* of the thread projecting. The finger next is made to feel for the external pillar of the ring, and to push the cord downwards out of the way; and the needle is carried along it, and made to pierce Poupart's ligament; meanwhile the skin is moved downwards, so that the needle-point comes out at the first puncture. A *loop* of thread is left there and held, whilst the needle is withdrawn. The finger is next made to feel for the internal pillar, and the needle made to pierce the conjoined tendon, the internal pillar, and triangular ligament, half an inch above the pubes. The point is brought out at the same aperture as before, the end of the thread is pulled out, and the needle withdrawn. The two separate ends of thread which have perforated the internal pillar, and the loop which has perforated Poupart's ligament, are pulled tight, and are passed through a hole in a boxwood pad, and tied over a bar. Thus the inguinal canal is first filled with invaginated fascia and sac ; and then its sides are brought together by this subcutaneous suture, so that it is contracted and made to adhere to the invaginated tissues. A pad and bandage are applied, and the ligatures allowed to remain three or four days.

In this operation the skin is not invaginated ; consequently it has no tendency to drag down the other invaginated tissues ; on the contrary, it tends to keep them in their place. The time required is shorter ; and although some degree of varicocele is apt to follow, yet this cure is more speedy, more certain, and less painful on the whole than Wützer's operation.

Mr. Redfern Davies has cured femoral and ventral hernia by the following simple operation :—The finger is made to pass into the femoral ring, thus invaginating a portion of integument. A curved tube containing a needle is carried up upon the finger, and a silver wire is sent through the two folds of integuments. One or more silver wires are passed in the same way. They are then sent through pieces of vulcanized India-rubber ; they are drawn tight, and rendered fast by split shot being clamped upon them. In about eight days the wires are removed, and a very light truss should be worn until the invaginated integument has become firmly adherent.

To Mr. Spencer Wells much credit is due for all he has done regarding Wützer's operation, and also for the success with which he has employed metallic stitch in the radical cure of femoral and ventral hernia, of which an account will be found in the "Medical Times" for Feb. 5, 1859.

IRREDUCIBLE HERNIA.

Definition.—A hernia is said to be irreducible when it suffers no constriction and yet cannot be returned into the abdomen. For facilitating the description of this form of the disease, it may be useful to attend successively to the causes which prevent reduction, to the dangers and inconveniences which may arise from irreducible hernia, and to the treatment.

Causes which prevent reduction.—First. A frequent cause which prevents reduction, is the bulk of the protruded parts in relation to the opening through which they would have to return. The bulk is, in some instances, owing to the quantity of parts which have come out of the abdomen, in others to the enlargement or growth of the hernial contents. The omentum and mesentery are the parts which, when protruded, present the impediment to reduction from growth; and their increase is occasioned mostly by the deposition of fat in the portions of these tissues external to the opening through which they came out from the abdomen. Where they are embraced by the opening, the pressure prevents enlargement in that situation; but from the yielding nature of the textures external to the opening, the increase of volume is often very considerable.

Second. Constriction of the neck of the hernial sac is occasionally the obstacle to reduction. That this condition of the neck of the sac sometimes exists to an extent sufficient to constitute, without an operation, an insuperable impediment to reduction, is a point regarding which surgeons are agreed. Not only is the sac necessarily narrower at the neck than in any other situation, from the manner in which it is embraced by the surrounding textures, but it is liable to be still further diminished by changes without and within the sac, and in the substance of the sac itself. For a minute description of these changes, the conditions under which they most frequently take place, and the nature of the action by which they are produced, I beg to refer to the section on the anatomy of the hernial sac, and the seats of stricture in the different species of hernia; and meanwhile I shall only remark that thickening and induration of the cellular tissue around the sac, effusion and organization of lymph without, and often also within the sac, and a thickened and indurated state of the sac itself, are the principal conditions which, separately or in various degrees of combination, diminish the canal of the sac, so as to prevent reduction.

Third. Adhesions of the protruded parts to the hernial sac often constitute the impediment to reduction. Of these adhesions there are three varieties:—1. The protruded parts sometimes adhere to the sac through the medium of a layer of coagulable lymph. This form was described by Scarpa as the gelatinous or glutinous adhesion, and as this is a condition of parts which very quickly takes place, the surgeon should endeavour to reduce the hernia as soon as possible, in order to prevent the slight inflammation which gives rise to the effusion.—2. Adhesions sometimes assume a membranous or filamentous appearance, varying greatly both in the number and length of the filaments,—in the number, from a single band to several, and in length, from two or three lines to an inch and upwards, as a general rule. Adhesions of this form are found only connecting movable parts with each other, as the intestine with the hernial sac, or with the omentum; and they are precisely similar to the bands we often find between serous surfaces in other parts of the body. They are produced by the effusion of coagulable lymph, which ultimately becomes organized—therein differing from the last-mentioned form—and which is drawn out into bands or filaments by the movements of the intestines. This accounts for their being found chiefly connecting moveable parts with each other, and for their being more frequent in the body and fundus of the sac than at its neck or mouth, where the parts are in a more confined space, and have less motion. This is now the almost universally received opinion of the origin of the membranous or filamentous adhesions. A different theory, however, was held by Scarpa, who erroneously believed that they are formed of elongations of portions of the serous coat of the intestine.—3. The third form of adhesion, which usually receives the name of the fleshy, is like the gelatinous and membranous, in being the result of adhesive inflammation; but differs from them, inasmuch as the union is close, firm, and deep, so that the protruded parts and the sac cannot be separated from each other, but form a solid mass, the vessels of which are continuous. In a case of strangulated hernia, the subject of operation, this form of adhesion demands a very different method of procedure from the gelatinous or membranous, as will be explained in the section on that subject. This species of adhesion is very frequently met with between omentum and hernial sac, and then is generally at the body and fundus of the sac; but when it is found between intestine and sac, which is a very rare occurrence, it is usually at the neck. Scarpa has described this form under the name of the unnatural fleshy, to distinguish it from what he calls the natural fleshy, which is of an entirely different character, and will be afterwards described. The three forms of adhesion agree with each other in being caused by inflammation, and in being attended with effusion of lymph; but they differ, inasmuch as the lymph in the first form is not organized; in the second, it is organized and elongated into bands or filaments; and, in the third, although organized, it is not elongated, but effused between the sac and protruded organs, and between the tissues of these parts, so as to convert them into a solid inseparable mass, the vessels of which are continuous.

Fourth. Adhesion of the protruded parts to each other often forms the impediment to reduction. The parts which form a hernia often glide down separately, and to a great extent, into the sac, and afterwards by pressure and various accidental causes become adherent to each other, and cannot in mass be returned through the opening by which they separately left the abdomen.

Fifth. Membranous bands across the sac constitute an insuperable obstacle to reduction. In reference to these bands, Sir Astley Cooper remarks,—"They appear to be produced in the following manner: during the reducible state of the hernia, inflammation takes place, both in the contained parts and in the inner surface of the sac; but by using proper means, the protruded parts are reduced, and the sides of the sac collapse and adhere together. However, while the adhesions are still recent, a fresh descent takes place from the abdomen, and the hernial contents again disunite the surfaces of the sac everywhere, except at the points of union of the inflamed parts, the cementing lymph of which, instead of bursting asunder, elongates with the fresh pressure, and forms those membranous bands which are seen passing from one side of the sac to the other. Between these the intestine and omentum get entangled, a circumstance which adds so much to the difficulty of reduction, that it is in general considered to be impracticable.

Sixth. The obstacle to reduction is sometimes furnished by the natural means of connexion between the intestine before its descent and the peritoneum lining the surrounding part of the abdomen. It is of the greatest importance that the surgeon should have clear and distinct ideas of this condition of a hernia; for if it be not understood, and if an irreducible hernia of this kind should become strangulated and require an operation, the most dangerous errors may be committed.

Scarpa gave an exceedingly clear and full explanation of this condition of a hernia; it has also been described by Pelletan, Cloquet, and Hesselbach, and with great distinctness by Mr. Lawrence. Pott, in two parts of his valuable work, refers to the difficulty of reducing certain herniæ, where there is reason to believe the obstacles to reduction arose from this condition; but from the manner in which he expresses himself, it is not evident that he understood the real cause of the impediment. The natural means of connexion of the hernia to the surrounding parts, may form the obstacle to reduction on the right side, if the hernia be formed of the cœcum, or head of the colon; or on the left, if it be formed of the sigmoid flexure of the colon. These divisions of the alimentary canal are completely covered by peritoneum, laterally and anteriorly, but are destitute of a peritoneal covering behind; and the peritoneum is reflected from their lateral aspects to the parietes of the abdomen in the ilio-lumbar regions, with which parietes it is connected by loose cellular tissue capable of great dilatation. The natural means of connexion of these divisions of the alimentary canal with the parietes are short, and formed of peritoneum between that portion of it which furnishes a serous coat to the intestines and that which lines the walls of the abdomen. If these portions of alimentary canal descend to form a hernia, they will drag along with them the part of the peritoneum which naturally lines the parietes of the ilio-lumbar region, to form the hernial sac; and if the hernial sac descend into the scrotum, and there form adhesions to the surrounding parts, the portions of peritoneum which, within the abdomen, preserved the intestine in its natural relations to the walls of the abdomen, will now retain it in the sac; and as, through the medium of these portions, the hernial sac and serous coat of the portion of intestine which forms the hernia are continuous with each other, it is evident that reduction must be impracticable. It is as impracticable, under these circumstances, to return the intestine as it would be to return the testicle into the abdomen; the intestine draws peritoneum along with it to form a hernial sac, and the testicle draws peritoneum to form tunica vaginalis; and the serous coat of the intestine has the same relation to the hernial sac, as the tunica vaginalis reflexa has to the tunica vaginalis propria. Such a hernia, when it becomes strangulated, and an operation is to be performed, requires a particular method of treatment, which will afterwards be explained.

Dangers from irreducible herniæ.—The chief dangers which may result from irreducible herniæ are, inflammation of the hernia, laceration or injury of the intestine from violence, extreme inconvenience from its size, and strangulation. The chief source of anxiety, however, in irreducible hernia, is the risk of its becoming strangulated—a state in which the life of the patient is placed in the most imminent danger.

Irreducible herniæ, even when left to themselves, do not always attain a great size; and sometimes they give rise to no inconvenience whatever, beyond a sense of weight and fulness in the parts affected. Sometimes they render the subjects of them liable to occasional colic pains, and derangement of the digestive organs, but in other instances these symptoms do not present themselves.

Treatment of irreducible hernia.—From what has been stated of the causes which render herniæ irreducible, and of the dangers which may result from them, the indications and rationale of treatment may be very easily understood. In every case the diet should be carefully attended to, and everything avoided which would be apt to produce derangement of the digestive system, and the bowels should be preserved free from constipation, as a loaded condition of the alimentary canal would, by increasing the distension, be likely to cause an increase of the protrusion; in short, the intestinal canal should, as much as possible, be preserved in a regular and natural state.

The hernial tumour should be carefully defended from any injury by external violence, and the greatest precaution taken to avoid every kind of exertion by which an addition might be made to the protrusion, or the parts already protruded be injured, or their condition in any way changed. To retard the growth of the hernia, and to diminish the probability of its proceeding to such a size as to cause inconvenience, the tumour should, if possible, be supported by means of a suspensory bandage; and if it has already attained considerable size, by a suspensory laced bag, by which an increase of the hernia is sometimes prevented, and its size diminished by absorption. Some of the best American surgeons recommend the gum-elastic suspensory, when the hernia is large, and a hollow truss when it is small, and say regarding them, that it is difficult to imagine anything more perfect, comfortable, and convenient. These precautions may be said to constitute the proper treatment of an irreducible hernia; and however little inconvenience a hernia may occasion, they ought never to be disregarded. In cases chiefly of omental hernia, containing much fat, the obstacle to reduction has been removed by confining the patient to bed for several weeks, keeping him on low diet, giving small doses of blue pill and tartar emetic, and keeping ice over the part. In my own experience in cases of the precise nature here stated, I have in several instances been successful.

STRANGULATED HERNIA.

A hernia is said to be strangulated when the protruded parts experience such a degree of pressure as not only prevents their return, but also, by compressing their blood-vessels, disturbs or in a measure suspends or impedes the circulation in them. This condition very speedily produces inflammation in the protruded parts, which extends itself from thence to the parts within the abdomen.

Symptoms.—There is pain in the swelling, beginning about the neck, or being at first most considerable there, and propagating itself gradually over the swelling in the direction from the abdomen. The swelling becomes tense, and there is for some time tenderness on pressure, afterwards pain on pressure, and that in some instances very acute. In some examples there are heat and redness. Such are in many cases the local symptoms; and if death do not very speedily take place, they occasionally change for a short time before its approach, the swelling becoming flaccid, the pain and tenderness on pressure wearing off, and crepitation being perceptible on examination:—such symptoms denoting the presence of gangrene.

The symptoms connected with the alimentary canal are, eructations, nausea, vomiting, and insuperable constipation of the bowels. At a very early period the patient is troubled with eructations, followed by nausea and vomiting. The contents of the stomach are first vomited, and afterwards, in consequence of inverted peristaltic motion, those of the canal between the stomach and the seat of the stricture. Bilious matter is brought up in large quantities, and the contents of the small intestine, and even of part of the large intestine, if any portion of that division of the alimentary canal should be placed higher up than the part included in the stricture. When the contents of the large intestine are brought up, the vomiting is called stercoraceous. The insuperable constipation is a striking symptom. It may be possible by means of clysters to wash out the portion of canal which is below the hernia; but it is impossible, while the strangulation remains, to procure any evacuation from the part of the intestine above the hernia; and this is not owing to a mechanical obstruction offered by the stricture, for the constipation is insuperable when the stricture only diminishes the calibre of the intestine, as well as when it includes an entire fold; and it is insurmountable in cases of omental hernia, after the inflammation has extended to the intestine. The constipation is owing to the same cause as in enteritis or ileus, of which strangulated hernia is an example, though differing from ordinary cases in being produced by a mechanical cause.

There are some symptoms connected with the abdomen, which are quite characteristic of strangulation; namely, a sensation as if a cord were tied tightly round the upper part of the abdomen, twisting pains about the umbilicus, and pain diffused over the whole abdomen, but generally more considerable from the seat of the hernia to the umbilicus. The abdomen after a certain time becomes tense, and, as the disease advances, tender and painful on being pressed, or stretched; and, therefore, the patient lies quite still, with the limbs drawn up, to relax the abdominal parietes. After a time, hiccough comes on, and the belly becomes tympanitic. The tongue is white and dry; the countenance pale, anxious, collapsed, and expressive of great suffering; the pulse, which from the beginning is small and hard, becomes very quick, and extremely small and thready; there is great sense of feebleness; the extremities ultimately become cold, and the surface of the body covered over with a clammy perspiration. When gangrene has actually taken place, the patient may experience a sudden and complete relief from all pain and tenderness in the swelling or abdomen; the former may feel emphysematous, a sure sign of gangrenous mischief; it may feel flaccid, or even return on slight pressure; the abdomen may become free from all tenderness on pressure, but it still remains tense; the patient may feel himself relieved from all suffering, and in many instances, even a few minutes before death, patients have expressed themselves as perfectly confident of recovery; but the pulse is extremely feeble, and usually in this state irregular; the clammy perspiration remains, and death very soon closes the scene.

Such are, generally, the symptoms of strangulation; but they are not in all cases of equal intensity or rapidity. When the patient is not advanced in life, when the hernia is intestinal and recent, and when the stricture is tight, the symptoms are alarmingly intense, and present the assemblage already described. In elderly persons, and more especially when the hernia is of long standing, the mouth of the sac probably being widened by the distension occasioned by the protruded parts, the symptoms are usually less urgent and slower in their progress, and for some time their appearance seems to indicate that they are to be referred to obstruction of the alimentary canal rather than to inflammation. There can be very little doubt that, in such cases, accumulation of fæcal matter from torpor of the intestine is frequently the cause of discomfort, and that the inflammatory process is a consequence arising from it. When the hernia is omental, the symptoms of strangulation are less violent and slower in progress than when it is intestinal; the pain and sense of constriction in the tumour are comparatively inconsiderable; the pain and tenderness of the abdomen not so urgent; the vomiting not so frequent; and the constipation not by any means so very obstinate; so that the bowels may be moved by enemata until the inflammation has reached the intestine, when, as in a case of ileus, it becomes insuperable. In some cases, but they certainly are extremely few, inflammation in the hernia is the cause of strangulation; but in by far the greater number of examples inflammation is the consequence of the constriction. Under all circumstances, the symptoms of strangulation furnish ground for the greatest alarm. Although cases are often known to go on for several days, others have terminated fatally in a very short time. The works of Larrey, Pott, Cooper, Hey, Wilmer, and others contain records of cases in which strangulation has been followed by death in less than twenty-four hours. Sir Astley Cooper alludes to a case in which death took place in eight hours after the occurrence of strangulation, and Larrey met with two examples in which only two hours elapsed between the occurrence of strangulation and the death of the patient. Strangulated hernia has the same general symptoms as ileus and intus-susception, and in addition to these it has its own peculiar local symptoms. The presence of the symptoms above described should always lead to a careful examination of the usual sites of hernial protrusion, and the absence of local swelling in such cases warrants the conclusion that they depend upon a cause which is intra-abdominal. Conditions, however, may exist requiring great care to form a correct diagnosis, namely, the co-existence of ileus with an irreducible hernia not strangulated, or the presence of ileus with an ambiguous tumour at any of the ordinary sites of hernial protrusions. The history of the symptoms, the absence of a sense of tension or of pain in the swelling, or of any alteration of the symptoms connected with the tumour, and there being little or no tenderness on pressure, render it extremely probable that the symptoms are independent of the local affection, or that the latter has no causal relation to them. The proper view to be taken of a strangulated hernia, I conceive, is, that it is a species of ileus produced by a mechanical cause.

Treatment.—Strangulation being caused by compression of the protruded parts, an indication of paramount importance is, to relieve them from the pressure as speedily as possible. With that view, replacement should in most cases be attempted by a certain manual process, technically called the operation of the taxis. To diminish the tension of the opening, through which the parts are protruded, the patient should be placed in the recumbent posture, with the trunk bent a little forward, and the thigh of the affected side raised upwards and inwards. With the fore-finger and thumb of one hand, the tumour should be embraced at its neck, and replacement attempted by a kneading or pinching movement at that part, while with the other hand the tumour should be subjected to general pressure; the object being, not to push back the hernial contents in mass, but to knead up the tumour, bit by bit; and in doing this, it is necessary to observe the course which the protruded parts must have taken, that the direction of the pressure may be accommodated to it. Before attempting to press up the tumour, it is often advantageous to draw the hernia downwards, as if the object were to draw the hernial contents farther from the abdomen. By this proceeding, the neck is rendered straight, and an obstacle, offered by the hernia being much swollen on the aspect of the stricture farthest removed from the abdomen, is diminished, so that the taxis can be employed under more favourable circumstances. The taxis should be employed gently, steadily, and cautiously, without any force or violent effort, and even when used most prudently, it should not be continued for more than eight or ten minutes; nor should it be persevered with after it has been ascertained that there is no reasonable prospect of success.

In some cases of strangulation, it would be extremely injudicious to use the taxis at all, or any treatment except operation. To this class of cases belong those in which the hernia has become gangrenous, or in which there is reason to believe that the intestine has become so much softened by inflammation, as to be in danger of giving way, if subjected to the slight pressure of the taxis. In such circumstances, fæcal extravasation and death would be the consequences of returning the hernia. The proper treatment of such cases will be explained when describing the operation for strangulated hernia. At one time, bloodletting, tartar emetic, the warm bath, tobacco and other enemata, and the application of ice, were used as auxiliaries to the taxis, but now they are all superseded by the use of chloroform. If a patient labouring under symptoms of strangulation be brought completely under the influence of chloroform, and if, on the decided, skilful, and thorough employment of the taxis, the hernia cannot be returned, the surgeon may reasonably conclude that the constriction is too great to be overcome by any means short of an operation. He should therefore spare the patient the danger resulting from delay and unnecessary handling, and at once proceed to the operation.

OPERATION FOR STRANGULATED HERNIA.

There are some peculiarities with regard to the forms of the incisions and other important points in the operations for the different species of hernia, which will be referred to when the different species are described; but there are some considerations regarding the operation in general, a correct knowledge of which is indispensable. Some of the most important of these are—1st, The circumstances under which it is justifiable or necessary to resort to the operation;—2nd, The importance of having recourse to operation at an early period, and of abstaining from handling the hernia before the operation, more than is necessary for the fair and skilful use of the taxis, while the patient is under the influence of the most powerful auxiliary—chloroform;—3rd, The indications which are to be fulfilled by the operation;—4th, The conditions which render it impossible, and those which make it improper, to return the hernia;—5th, The mode of procedure in regard to the hernial sac;—6th, The anatomy and treatment of abnormal or artificial anus;—and, 7th, The treatment after operation.

1st. The operation is justifiable and necessary when the patient has been brought fully under the influence of chloroform, and when the taxis has been fairly, fully, and skilfully tried, and failed to produce the desired effect. The conviction being thus produced that by no other means than an operation is there hope of saving the life of the patient, it ought to be resorted to as quickly as possible.

2nd. From what has been stated as to the condition of the parts in strangulated hernia, it must be evident that much handling or pressure of the hernia must not only give unnecessary pain, but also increase the risk of hurrying on the inflammation to results which, even though the operation should be performed, would render it unsafe to return the hernial contents. When, therefore, the taxis and other remedies have been fairly and skilfully tried, no advantage can, but considerable injury may, result from the repetition of treatment already found to be unavailing. So deeply was the celebrated Desault impressed with the belief of the injurious effects of pressure and handling, that he confided in other means for accomplishing reduction, and entirely prohibited the taxis in cases brought to the Hôtel-Dieu, until by other means the parts were brought into a state in which they could be returned with little difficulty.

3rd. The indications which are to be fulfilled by operation are two—the first, which is essential for the safety of the patient, is the removal of the pressure by division of the stricture; and the second, which, when possible and proper, is very desirable, is the return of the hernia. In many instances, especially when the hernia is small, intestinal, and not of long standing, it returns very suddenly on division of the stricture; in other cases there are some obstacles apart from the stricture, which can very easily be removed;—for example, of the four varieties of adhesion mentioned, among the causes which render hernia irreducible, the soft recent adhesion formed by coagulable lymph, called by Scarpa the gelatinous or glutinous adhesion, can be broken down by the finger, and the filamentous adhesion can be divided by the knife.

4th. The principal conditions which render it impossible to return the hernia after division of the stricture are two forms of adhesion, namely, the adhesion by the natural means of connexion, and the close organized adhesion,—described by Scarpa as the natural and unnatural fleshy adhesions. When either of these conditions exists, the stricture should be divided, and then the coverings of the hernia should be replaced, and proper means taken to heal the wound. Another obstacle frequently met with in hernia of great size is, adhesion to each other of the different parts forming the hernia. In such cases, if the hernia consist of omentum alone, part may be cut away, and the rest returned to the mouth of the sac, the hemorrhage being stopped by pinching the vessels with a forceps, or including them in fine ligatures, while great care is taken not to include any part of omentum along with them. Such are the principal conditions which render it impossible to accomplish reduction; the stricture, however, being divided, the principal cause of danger is removed. There are certain states in which it would be extremely improper to attempt reduction, namely, when the hernial contents are gangrenous, or when the intestine has given way, from inflammation having gone on to gangrene, or when it has been torn, or accidentally wounded in the operation. The two last-mentioned conditions can only result from unskilfulness in the mode of procedure; but should they exist, the hernia should not be returned. From what has been stated it will be understood that, in all cases in which it is possible, if the intestine be sound and entire, reduction should be attempted. When the intestine presents such an appearance as to render it doubtful whether it can retain its vitality, or whether its return may be followed by fæcal extravasation, the surgeon should content himself with carefully dividing the stricture, replacing the coverings, and using proper means for the healing of the wound. When the intestine is gangrenous, the stricture should be carefully divided, but in doing so the greatest caution should be observed not to disturb any of the adhesions around the neck of the hernia; the gangrenous portion should be laid open, its contents cleared out as completely as possible, and the coverings replaced; but no attempts made to close up the wound. There is some difference of opinion among surgeons as to the most prudent method of procedure in regard to the stricture when the intestine is gangrenous. While they agree as to the propriety of opening the intestine and clearing out its contents, some disapprove of any attempt to divide the stricture, as both unnecessary and injudicious—unnecessary, inasmuch as they suppose that the evacuation of the intestinal contents will in every instance sufficiently remove the pressure; and injudicious, from the risk of destroying the adhesions by which the intestine is retained at the mouth of the sac,—a condition essential for diminishing the danger of fæcal extravasation into the cavity of the abdomen. But others recommend a careful division of the stricture, lest dangerous pressure should still remain; and as it is possible to accomplish division without any risk of breaking down the adhesions round the whole of the neck of the sac, this seems the most advisable procedure, except when the gastric portion of intestine evidently and freely sends down its contents through the wound: in which case division of stricture is not so essential.

Teale in his admirable work on Hernia remarks on this subject: "Louis maintained that the division of the stricture was not necessary for the evacuation of the intestinal canal, after a free incision had been made into the gangrenous portion of the intestine;" and Travers has strongly objected to the division of the stricture under these circumstances, on the ground of its disturbing the adhesions, and being unnecessary for the evacuation of the bowel; nevertheless, he admits that this rule of treatment may have its exceptions. "If," says Travers, "the stricture should still be sufficient to retain the matters, which will seldom be the case, a moderate dilatation of it will be required." Lawrence coinciding with Travers in opinion that the division of the stricture is generally unnecessary, states that if the stricture be so narrow as to interfere with the discharge, an incision must be made to afford the requisite room. To ascertain this point, as well as to discover if there be any interior constriction, Lawrence recommends that the end of the little finger, or a female catheter, be cautiously introduced into the bowel. Arnaud and Dupuytren divided the stricture, when the fæces did not freely escape. The general practice of Sir A. Cooper was to divide the stricture. Key is of opinion "that the danger of disturbing the adhesions has been exaggerated, and states that a director may be passed between the intestine and stricture without materially disturbing the adhesions." In all cases in which the intestine is not entire, whether from having been purposely laid open, or from having given way of itself, or from having been torn or cut by unskilful procedure, it should be allowed to remain, so that the fæces passing off by the wound may form an abnormal anus, and extravasation into the abdomen be thereby prevented. The wound should be left open to facilitate the free discharge of the intestinal contents, and simple dressings frequently renewed. The anatomy and treatment of artificial or abnormal anus will be afterwards explained. When omentum forms the hernia, and it is gangrenous, the gangrenous portion may be removed, and the remaining part returned to the abdominal aspect of the mouth of the hernial sac. These remarks, it is hoped, will be sufficient to point out the proper mode of procedure regarding the hernial contents, when the hernia is sound and reducible, when it is irreducible, and when it is in any of the various conditions in which reduction would be dangerous and improper.

5th. The mode of procedure with regard to the hernial sac. After the other coverings have been divided by incisions varying according to the situation of the hernia, the sac should be pinched up, by means of a forceps, where it is seen to be separated from the hernial contents by some serous fluid, if such separation be perceptible, or where it lies over omentum, if that structure appear to form any part of the front of the hernia, and it should then be opened by holding the knife in a horizontal position. The point of the fore-finger should then be sent up within the sac in front of the hernial contents, and the hernial knife carried up flat upon the finger as a director, care being taken not to allow the edge of the knife to touch the hernia. The stricture should then be divided through the neck of the hernial sac, the direction of the division being from behind forwards. On the return of the hernial contents the sac is usually allowed to remain in the wound, because in most instances it has such adhesions to the surrounding parts as make its return impossible.

It is a question of great importance, in reference to the operation for strangulated hernia, which of the two following modes of proceeding in regard to the hernial sac is the more advisable; namely, that of opening the sac, and dividing the stricture from within; or that of dividing the stricture, and replacing the parts without opening the sac. Of these two, technically called the *intra-peritoneal* and *extra-peritoneal* modes of division, the former is that which, except in a limited number of cases, has received the sanction and adoption ot most surgical authorities in these islands. It appears certain that, in the great majority of cases, it is by that mode alone that it is possible to accomplish the two grand indications which it is desirable to fulfil by the operation; namely, the removal of the pressure by division of the stricture, and the return of the hernia. The fulfilment of the former, namely, the removal of the pressure by division of the stricture, is essential to the safety of the patient; and that of the latter, the return of the hernia, exceedingly desirable when practicable and proper.

With regard to the FIRST indication, when the stricture is external to the sac, as is not unusual, it is possible to divide it by adopting either mode; but if formed by the sac, or within it, it is clear, that by intra-peritoneal division alone can the more important indication be fulfilled, or any good effected. Cases belonging to the latter class are by no means of unfrequent occurrence. That the neck of the hernial sac occasionally constitutes the stricture, is a point regarding which surgeons are agreed, instances having been recorded by the great surgical authorities of this and other countries, and examples occurring frequently in the practice of many surgeons. The sac, necessarily narrower at its neck than in other parts, is liable to be still further diminished by effusion and organization of lymph, either on its outer or inner surface, as well as by a thickened and indurated state of its own substance,—conditions which, separately, or in various degrees of combination, diminish the canal of the sac. For eighteen years I have availed myself of every opportunity of examining the condition of hernial sacs, and from my dissections I am led to conclude, that, in herniæ of considerable standing, thickening of the neck is of frequent occurrence. Although constriction, when sufficient to render a hernia irreducible, is usually at the neck of the sac, yet it is not invariably so. This fact is of little practical moment if a hernia be merely irreducible; but it becomes of the greatest importance if it be strangulated, and require an operation, as the paramount object of the operation is to divide the constriction, in order to relieve the symptoms of strangulation. The stricture is occasionally found within the sac. In a very few instances it has been found to be occasioned by a loop of intestine; in some by a band of omentum; and in others by a band of lymph effused from the serous coat of the intestine, and surrounding and constricting it as by a ligature.

This last-mentioned condition has been described and delineated by Sir Astley Cooper. It has also been met with by other surgeons; and not fewer than four cases of it have come under my own observation. The *first* case was that of a female about sixty years of age, of a full habit of body, and the subject of a strangulated umbilical rupture. Her medical attendant, a surgeon of long standing in Aberdeen, found it necessary to have recourse to an operation, and of that I was a witness. The hernia returned very suddenly as soon as the margin of the umbilicus was slightly divided; but the symptoms of strangulation continued, and the patient died in ten hours after the operation. I was requested to conduct the post-mortem examination; and, on opening the abdomen, found behind the umbilicus a swelling about the size of a small orange, formed of intestine, with a neck surrounded by a band of lymph, which embraced and constricted the part, as by a cord. The lymph had been effused from the serous coat of the intestine, in consequence of the inflammation excited by the pressure of the margin of the umbilicus. In this case the hernia returned, but without the stricture having been divided. The *second* case was that of a female, a patient of my own, about the middle period of life, on whom I had occasion, with the assistance of Mr. Paterson, surgeon in Aberdeen, to perform the operation for strangulated femoral hernia. On carrying up the point of my finger between the hernia and hernial sac to feel for the stricture, I was struck with the circumstance, that the tightness of what I supposed to be the stricture bore no ratio to the extreme urgency of the symptoms of strangulation, and that, after dividing some of Poupart's ligament, by cutting from within the hernial sac, the intestine, on being gently pressed, still remained as tense as formerly, and its contents did not seem to be moved by the pressure. I therefore examined the neck of the hernia with my finger, and perceived a band of lymph keeping the part tightly constricted, and, in short, constituting the stricture. I gently drew down the intestine, and cut the band in several different parts, when the contents of the intestine could be easily made to move upwards. On being satisfied that all constriction was removed by dividing the band of lymph in various parts, the intestine was returned into the abdomen, and the patient recovered without an unfavourable symptom. If the hernia had been returned without this band of lymph having been discovered and divided, the object of the operation would have been unaccomplished. The *third* case was that of a female, about sixty years of age, of a remarkably full habit, and who, about two days before I saw her, had been seized with symptoms of strangulation. When I first saw her, the abdomen was tympanitic to a great degree; the vomiting was most distressing; the bowels had not been moved for five days, and she had every symptom of sinking very rapidly. She stated that she had often on previous occasions had attacks of what she believed to be colic, and imagined at first that the illness from which she was suffering was only a return of that disorder, and, consequently, anticipated a speedy recovery. I was also informed that, for a considerable time, she had a disagreeable feeling of tenseness in her left groin, though without swelling, so far as she could perceive; and that, some hours before I was called, while drawing up her limbs in a fit of retching, she felt, to use her own expression, as if something had given away in her groin, and from that moment was relieved from all feeling of tenseness. The symptoms of strangulation, however, continued. I made a most minute examination of all the usual seats of hernia, but could detect no symptom of such a lesion. I requested my colleague, Professor Macrobin, to attend the patient along with me, which he did, and he was also present at the post-mortem examination. On opening the abdomen, there was at its lower part a small tumour of intestine seen, before any parts had been disturbed beyond merely turning down the abdominal parietes. It was of a livid colour, about the size of a walnut, and with a narrow neck, tightly embraced by a band of lymph, by which it was so constricted as to make it difficult to pass a probe from that part of the intestine which led to the swelling, into that which constituted the tumour. The intestine was also twisted over itself in form of a loop. On examining the femoral canal of the left side, a hernial sac was found in it; and the tumour of intestine had, no doubt, formed a hernia, but returned of itself. The stricture, however, formed by a band of lymph, still remained. Sir A. Cooper records a case in which Weston returned a hernia by the taxis without an operation; but the symptoms of strangulation continued, and it was found that the stricture was caused by a band of lymph which embraced the intestine. In the instance of my patient, the hernia returned without any assistance. The *fourth* case was that of a female, whom I had never seen during life, but at the post-mortem examination of whose body I was present, in consequence of the request of a medical man who had seen her a short time before death, and who had also often attended her on previous occasions, when in a state of great suffering from disease of the womb. The symptoms, I was informed, were those usually induced by a strangulated hernia; but the medical man could not detect any swelling in any of the usual seats of hernia. On examining the left groin before opening the abdomen, I thought I felt a very small swelling, which I suspected to be a hernia, and I therefore made a careful dissection of the parts in presence of the surgeon, who requested me to do so, and of one of my pupils. On cutting through Poupart's ligament from before backwards, the contents of a small hernial sac returned into the abdomen without being touched, and were found to consist of intestine strangulated by a band of lymph, embracing the neck of a small hernia. The hernia was not much larger than a walnut. If it had been discovered during life, and made the subject of operation, there would have been great risk of its returning into the abdomen without the real stricture being discovered or divided.

From what is stated above, it appears very clear that the extra-peritoneal mode of herniotomy is quite unsuitable when the stricture is formed by the sac or within it, whatever be the nature of the stricture itself; and the above-mentioned examples of strictures formed by membranous bands, suggest very strongly the propriety of great caution in arriving at the determination of adopting the extra-peritoneal division; as well as, in those cases in which the sac is opened, of examining very carefully, before the hernia be returned, whether membranous bands do or do not exist.

The SECOND indication which it is desirable to fulfil by an operation, is the return of the hernia. With a view to facilitate the inquiry, as to which of the two modes of procedure is the more suitable, cases may be arranged into the three following classes:—

First, Those in which the stricture is external to the sac, in which it is neither impracticable nor improper to return the hernia, and in which no obstacle exists to that return after the stricture has been divided. Secondly, Those in which an obstacle does exist after division of the stricture: and, thirdly, Those in which the return of the included intestine would be practicable, but improper.

First. In cases belonging to the first class, either mode is applicable; but extra-peritoneal division being attended with much less danger, is decidedly preferable.

Secondly. In regard to cases in which, independent of the stricture, an obstacle to reduction exists, it will be proper to consider what are the principal obstacles most frequently met with. These are adhesions of the protruded parts to the hernial sac, the natural means of connexion, in some rare cases; adhesions of the protruded parts to each other; and the large size of the hernia. For a description of these obstacles to reduction the reader is referred to the section on Irreducible Hernia. If any of these conditions exist, and if the sac be not opened, reduction is in general impracticable. If the sac be opened, two of them may easily be overcome; namely, the soft recent adhesions, formed by coagulable lymph and the filamentous,—the former can be broken down with the finger, the latter divided by the knife. Two of them present an insuperable impediment to reduction; namely, the natural means of connexion, and the close organized adhesions, if these be to a great extent, and the hernia large. With regard to the two remaining conditions, the possibility of overcoming them, and the propriety of attempting to do so, must depend entirely on the particular circumstances of the case; but it is frequently more judicious not to interfere with them, unless they exist only to a limited extent, and in herniæ of moderate size. Most of these conditions, however, are principally met with in cases of large and old hernia; and, on account of the risk of injuring the intestine in attempts at reduction, as well as that of inducing dangerous inflammation by much handling of the intestine, and the difficulty of maintaining the parts reduced, even should reduction be possible, the majority of surgeons follow the advice of Sir A. Cooper regarding such cases. His practice was, to divide the stricture, which fortunately in such cases is, for the most part, external to the sac, and to leave the latter unopened, and the hernia unreduced. The stricture being divided, the principal cause of danger is removed. The coverings of the hernia should be replaced, and proper means taken for promoting the healing of the wound.

Thirdly. There are certain states in which it would be extremely improper to attempt reduction; namely, when the hernia is gangrenous, or when the intestine has given way, owing to inflammation having gone on to gangrene, or when it has been torn, or accidentally wounded in the operation. The two last-mentioned conditions can only result from unskilfulness in the mode of procedure; but, should they exist, the hernia ought not to be returned. When the intestine presents such an appearance as to render it doubtful whether its return may be followed by fæcal extravasation, the surgeon should content himself with carefully dividing the stricture. In all cases in which the intestine is gangrenous, or not entire, from whatever cause, it ought to be allowed to remain, so that the fæces passing off by the wound may form an abnormal anus, and extravasation into the abdomen be thereby prevented. When omentum forms the hernia, and it is gangrenous, the gangrenous portion may be removed, and the remaining part returned to the abdominal aspect of the mouth of the hernial sac. The practice of removing a portion of omentum, when from growth it renders a hernia irreducible after division of the stricture, is a proceeding which, in some cases, may be adopted with advantage. For cases belonging to this class, extra-peritoneal division is of course quite unsuitable. These remarks, it is to be hoped, will be sufficient to point out the proper mode of procedure when the hernia is sound, and reducible after division of the stricture; when it is irreducible after such division; and when it is in any of the various conditions in which reduction would be dangerous and improper; and also to show, that to follow one method indiscriminately in all cases would be unwise; that intra- or extra-peritoneal division should be adopted, according to the particular circumstances of the case; that, in the majority of cases, intra-peritoneal division is not only the more suitable mode, but the only one which is safe, or by which any good can be effected; and that the cases in which extra-peritoneal division is suitable are those of very short standing, where there is no reason to apprehend the existence of adhesions or of an unsound condition of the hernia; and those also of large and old hernia, where the more judicious proceeding is, to divide the stricture, and not to attempt reduction.

The plan of not opening the sac, although practised in certain cases by Franco and Paré, was first strongly recommended by Petit, and consequently has been designated the *method of Petit*, to distinguish it from that in common use. Petit practised this method as early as 1718. It was subsequently advocated by Garengeot; and, at a still later period, adopted and strongly recommended by Bonnet of Lyons.

In this country it was introduced by the second Monro, who advocated its adoption in cases of small and recent hernia, and mentioned four cases in which he resorted to that mode of proceeding. In one of them, however, adhesions prevented the return of the hernia, and in two of them he was obliged to cut the neck of the sac. In later times, the same proceeding was adopted by Sir A. Cooper in cases of large and old hernia, and strongly recommended by him as the decidedly preferable mode in cases of that class. Lawrence, in his valuable "Treatise on Ruptures," remarks, "The plan of removing the stricture, and returning the prolapsed parts without opening the sac at all, ought, I think, to be more frequently adopted than it has hitherto been although it appears objectionable, as a measure of general use, in the operation for strangulated hernia." To Key, however, the merit undoubtedly belongs of having recommended a more general adoption of Petit's mode than had previously prevailed in this country. In his admirable "Memoir on the Advantages and Practicability of dividing the Stricture in Strangulated Hernia on the outside of the Sac," will be found much valuable information on this interesting subject. Mr. Luke strongly recommends this mode, and his success is a decided testimony in its favour. Out of nearly forty patients he has not lost more than two. Mr. Liston showed me a patient in whose case he had adopted this mode; and, in a communication I afterwards received from him, he informed me that he had practised it in a few other instances, and felt convinced of its being the preferable mode when the hernia is small and recent, and when there is no reason to apprehend an unsound state of the intestine. And, judging from the statements of others, this mode seems to be meeting with deservedly increased favour; and I have no doubt will continue to do so, if practised under the limitations already mentioned. Mr. Gay's modification of this operation is admirably adapted for a certain class of cases, especially of femoral hernia. It consists of making an incision about an inch in length over the neck of the hernia, carrying the tip of the finger under the stricture, and dividing it by a bistouri caché without opening the sac.

There can be no doubt that intestinal inflammation is the most frequent cause of death after the operation for strangulated hernia. Some of the advocates of Petit's method have assigned as the causes of that inflammation, when the ordinary proceeding is adopted, the exposure of the intestine to light and air, change of temperature and handling. I agree with Lawrence in ascribing it not to these agents, but chiefly to the long-continued pressure of the stricture, owing to the operation being *too long delayed*, and to an injudicious and *too frequent use of the taxis* previous to the operation. I remember being very much struck with an observation of Desault's; I have not his works beside me at present, but it is to this effect:—"Think well of that hernia which has been little handled and soon operated on." The operation is justifiable and necessary when the patient has been brought fully under the influence of chloroform, and the taxis has been fairly, fully, and skilfully tried without producing the desired effect. The conviction being thus produced, that by no other means than an operation is there hope of saving the life of the patient, it ought to be resorted to as quickly as possible. Much handling must not only give unnecessary pain, but also increase the risk of hurrying on the inflammation to results which, even though the operation should be performed, would render it unsafe to return the hernia. When, therefore, the taxis has been fairly and skilfully tried on a patient fully under the influence of chloroform, no advantage can, but considerable injury may, result from the repetition of treatment already found to be unavailing. Many considerations show that the operation should be performed as soon as possible after its inevitable necessity has been found to exist. Delay, like undue handling, increases the risk of inducing such a state of the hernia, in consequence of inflammation, as would render its return unsafe. From the circumstance that a hernia may speedily prove fatal, and from the depressed state which comes on in consequence of delay, rendering the patient less able to stand the shock of an operation, will be seen the importance of being as prompt as possible; but there is another, and a very urgent reason—namely, that, if the operation be delayed until intestinal inflammation has been induced within the abdomen, it is far from certain that this inflammation will subside on the removal of the hernia which caused it. During a period of eight years I have performed the operation for strangulated hernia, according to the usual mode, twenty-three times in all, and with success in every instance but one. In that, death occurred in consequence of an attack of phlegmonous erysipelas, which commenced after the patient was considered to be out of danger. This success I attribute to two things—namely, avoiding all undue and useless handling, and performing the operation early. My decided impression is, that the reason why the operation is so frequently followed by death, instead of being one of the most successful of the great operations of surgery, is, too great delay in resorting to an operation, and the undue and injurious use of the taxis, even after its adoption has proved unavailing.

6th. Abnormal or artificial anus, its anatomy and treatment. Whenever the intestine is unsound, or not entire, it should be allowed to remain, the safety of the patient in such cases consisting in the formation of an abnormal anus. Lymph is thrown out along the abdominal aspect of the mouth of the sac, by which means the intestine becomes connected to the walls of the abdomen, and the danger of fæcal extravasation is diminished. The portion of intestine leading to the abnormal anus, that is, the upper or gastric portion sends down its contents, and they are discharged by the wound; their transmission into the lower or rectal portion, that is, the part leading from the abnormal anus, being prevented partly by the contraction of that portion from being empty, and its retraction; but principally by the septum formed by the contiguous portions of the bowel. The completeness of this partition, called by some the spur (l'éperon), and, consequently, of the hindrance of the passage of the fæces from the one end of the intestine to the other, varies according as the entire diameter of a loop of intestine, or a part of it only, is included in the stricture. If the whole diameter be included, the portions of intestine will be in a measure parallel, and the partition complete. The danger of abnormal anus varies according to the part of the bowel affected. If it be a portion of the great intestine, the only consequences may be discomfort and inconvenience; whereas if it be a portion of the small intestine, and more especially if it be near the commencement of the jejunum, the chyle will run to waste, and death from inanition probably follow. The upper portion remains open, its mucous membrane in some instances projecting, and discharges its contents into a cavity conical in form, the base being round the breach of the intestine, and the apex at the aperture in the abdominal parietes. An excellent writer on surgery says, "In an abnormal anus of long standing, another phenomenon is observed: the two ends of the intestine retract inwards. Scarpa explained this by a movement of traction exercised on them by the mesentery, which movement, we think, is owing solely to the peristaltic motions of the intestine. There is then formed a membranous canal from the intestine to the surface, called the funnel (l'entonnoir), which serves as a way of communication between the two ends of the intestine; and when the spur is not very prominent, but strongly retracted, it ends by bringing about the complete return of the fæcal matters into the inferior end, and the spontaneous cure of the artificial anus." Nature thus in some cases effects a cure without any other assistance than attention to regimen and pressure on the external aperture, for the double purpose of preventing protrusion of the mucous membrane, and of presenting an obstacle to the passage of the fæces outwards. Desault was the first who effected a radical cure of abnormal anus by surgical treatment; but his method, though successful, is not very generally applicable. To Dupuytren the merit belongs of having devised, and successfully practised, an ingenious and more generally applicable mode of effecting a radical cure. His object was the destruction of the septum, which offers the principal obstacle to the restoration of the normal canal; and the plan which he ultimately adopted for that purpose was, to produce a slough of the septum by subjecting it to pressure between the blades of a screw-forceps; the two blades having been introduced, one into each portion of the bowel, are made to approach each other by the turning of the screw, and the partition deprived of its vitality by pressure, ultimately comes away with the instrument, and the principal obstacle is thus removed. Of this method of treatment I have had no experience, but in the hands of Dupuytren it was found to be successful. It should never be ventured upon at an early period, lest the surrounding adhesions, which are so essential, should be broken, and lest the irritation should be so great that the extensive sloughing action produced might endanger the life of the patient. And when it is adopted, the utmost caution should be exercised, its effects should be closely watched, and care taken, especially at first, not to employ compression to such an extent as to cause distressing symptoms. The blades should not be introduced very far, lest by too extensive destruction an opening be made into the cavity of the abdomen, or lest a loop of intestine be included between the parts. The restoration of the canal is also promoted by the occasional introduction of tents or bougies into the inferior portion of the canal. Dupuytren's method of treatment is clearly most applicable to those cases in which the two portions of bowel are parallel to each other.

7th. Treatment after the operation for strangulated hernia. After reduction it is advisable in general to give a full opiate, and suitable means should be employed for promoting the healing of the wound: strict attention to rest, the recumbent posture, and the careful regulation of the diet, are indispensable. After some little time, it is advisable to endeavour to procure evacuation of the bowels by means of mild enemata; but on no account whatever, should purgative medicines be given by the mouth for some considerable time after the operation. If inflammatory symptoms should appear, they must be combated by local and, if necessary, general depletion, fomentations, attention to regimen, the exhibition of calomel and opium, and other appropriate remedies. Pressure over the wound should be kept up by means of a compress and bandage; and before the patient is allowed to get out of bed and resume the erect posture, by means of a truss, to diminish the danger of reprotrusion.

THE DIFFERENT KINDS OF HERNIA.

When situation is made the basis of arrangement, it is usual to divide herniæ in accessible situations into four principal classes—namely, *inguinal*, *femoral*, *umbilical*, and *ventral*.

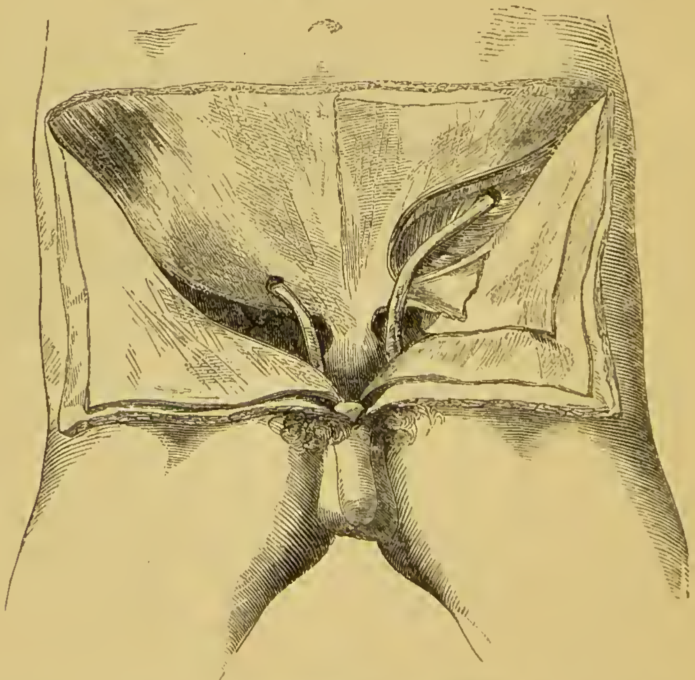
I. INGUINAL HERNIA.

In the language of surgery, inguinal hernia is a generic term, comprehending five different species—namely, *oblique*, *direct*, *congenital*, and *encysted congenital* inguinal hernia, and *hernia infantilis*. These species, though all connected with the inguinal canal, yet differ from each other in their anatomy, relations, seats of stricture, &c., and each, therefore, requires to be particularly described.

1. OBLIQUE INGUINAL HERNIA.

This hernia leaves the abdomen at the internal aperture of the inguinal canal. The points which it is of importance clearly to understand regarding this form of rupture will be seen by attending successively to its commencement—direction—coverings—relations to

Fig. 194.



Drawing of the parts concerned in inguinal hernia. Taken from a dissection made by me for the surgical class.

the inguinal canal, spermatic cord, and internal epigastric artery—its seats of stricture—and the operation, when symptoms of strangulation still continue after the employment of all the measures proper for that state.

1. *The commencement*, as has been already stated, is at the internal aperture of the inguinal canal, where it begins by pushing the peritoneum before it.

2. *The direction* varies in the different divisions of its course. While within the inguinal canal its direction is downwards, inwards, and forwards, so that in using the taxis, the pressure should be upwards, outwards, and backwards. After leaving the inguinal canal, its direction is downwards, inwards, and a little backwards. If such a hernia do not leave the inguinal canal, it is called a bubonocele; but if it reach the scrotum in the male, it forms what is called scrotal hernia, or oscheocele; or if the labium in the female, it constitutes a labial hernia:—these appellations being descriptive of the extent of the hernia.

3. *The coverings* of an oblique inguinal hernia, if it extend beyond the external aperture, are six in the male, and five in the female. In the male they are, from within outwards, the hernial sac, formed of peritoneum, the fascia infundibuliformis or internal spermatic fascia derived from the margin of the internal aperture—the cremaster muscle, called by some writers the fascia cremasterica—the external spermatic fascia—the superficial fascia, and the common integument. In the female the cremaster muscle is wanting.

4. The *relations of an oblique inguinal hernia to the inguinal canal, to the spermatic cord, and to the internal epigastric artery*, are the following. It comes down through the canal, differing greatly in this respect from direct inguinal hernia. The cord is behind, and the hernia in front, as might be expected, considering the different ways in which the hernia and the cord reach the internal aperture; and the internal epigastric artery is to the pudic side of the neck of the hernia, but behind the fascia transversalis, and separated by it from the canal. If the hernia be of considerable standing, the different parts composing the cord may be separated from each other, some being sent to one side, and some to the other; and occasionally some have been found nearly in front; but these are deviations from the usual condition. The relation which is the most important of all to be kept in view is, that the internal epigastric artery is on the pudic side of the neck of the hernia.

5. The *seats of stricture* in this species of hernia are three—first, at the external aperture; this, however, is of very rare occurrence, except in cases of large and old hernia, when it is sometimes met with, and may then be formed either by the circumference of the aperture, or by the hernial sac; secondly, between the external and internal apertures, in which case it may be formed by the under borders of

the internal oblique and transversalis muscles, or by the hernial sac, or by being embraced by the fibres of the above muscles, the cord and the hernia having in some cases fibres behind as well as in front; and, thirdly, at the internal aperture, in which case it may be formed either by the fascia transversalis where it forms the aperture, or by the hernial sac. The correctness of these statements as to the seats of stricture and the parts by which they may be formed, I have had opportunities of testing in my own dissections and operations.

Fig. 195.

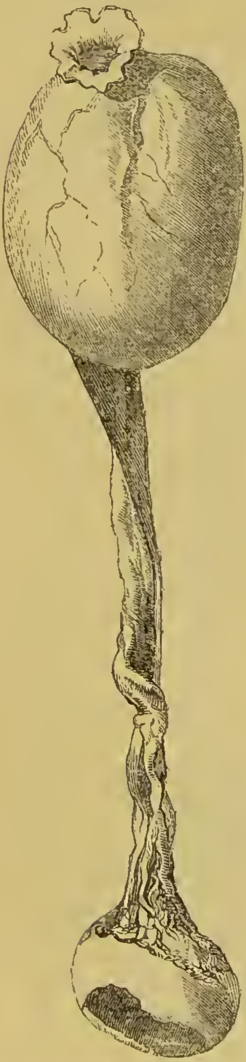


Fig. 195.—Hernial sac showing its usual situation in front of the spermatic cord. From a preparation in my own museum.

Fig. 196.

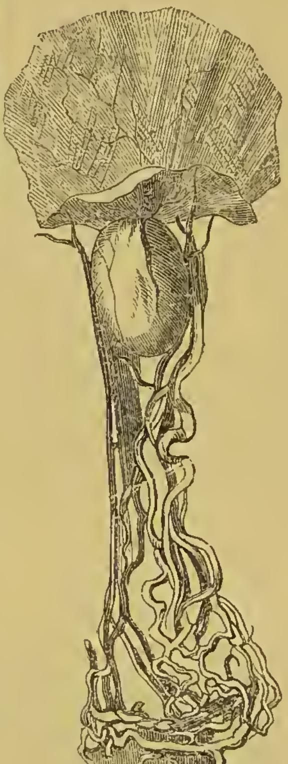


Fig. 196.—Hernial sac, accompanied by varicocele; showing the spermatic cord split, the vessels lying on one side, and the vas deferens on the other. Taken from a preparation in my own museum.

6. The *operation.* As all the details of the operation for strangulated hernia in general are applicable to the operation for this particular species, I shall here only point out the modifications rendered necessary by the anatomical relations. The incision of the integument should commence about half an inch above the internal aperture, follow the direction of the long diameter of the tumour, and descend to near its base. One simple incision suffices. The next step is, to lay bare the hernial sac by the cautious division of the other coverings, and if intra-peritoneal division be the prudent mode of procedure, to open the sac, attending carefully to the precautions already mentioned. The hernial sac having been opened, and the seat of the stricture ascertained by passing the point of the forefinger upwards within the sac and in front of the hernia, the hernial knife is sent up on the palmar aspect of the finger as a director, care being taken to avoid

wounding the hernia; and for this purpose it should be sent up with the side resting on the finger until its pointed extremity be within the stricture, when the edge should be turned forwards to the stricture and the division made, during which process the action of the right hand which moves the knife is accommodated to that of the left index finger which to a certain extent guides the knife, and also prevents the hernia from coming against its edge. An important question is, in what direction the stricture should be divided. If the stricture be at the external aperture, or at the under border of the internal oblique and transversalis muscles, there is no artery to be afraid of, and the division can be safely effected by carrying the knife upwards and inwards, directly upwards, or upwards and outwards; but if the stricture be at the internal aperture, there would be danger of wounding the internal epigastric artery if the incision were carried upwards and inwards; it can, therefore, be made with safety only in two directions, namely, upwards and outwards, or directly upwards. The same proceeding as regards the direction of the incision in dividing the stricture is adopted in all cases of inguinal hernia. It was first recommended by J. L. Petit, and by Scarpa, and afterwards by Richerand, Dupuytren, and other continental authorities; and in this country it was very strongly advocated by Sir A. Cooper, who recommended in all cases of dividing the stricture, to cut directly upwards—a practice which has deservedly received general adoption.

Fig. 197.

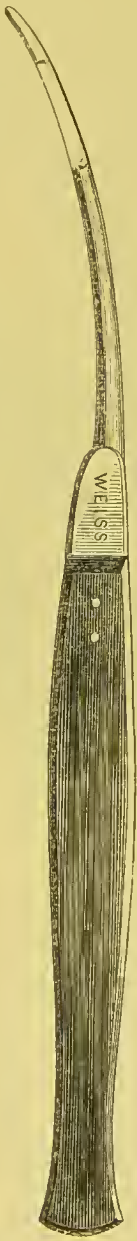
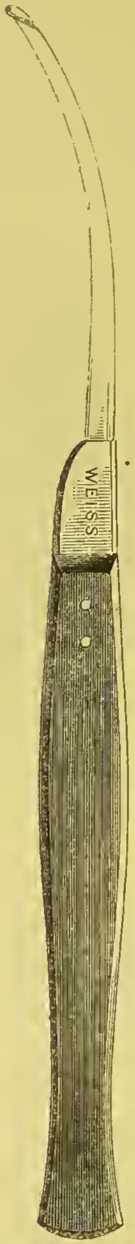


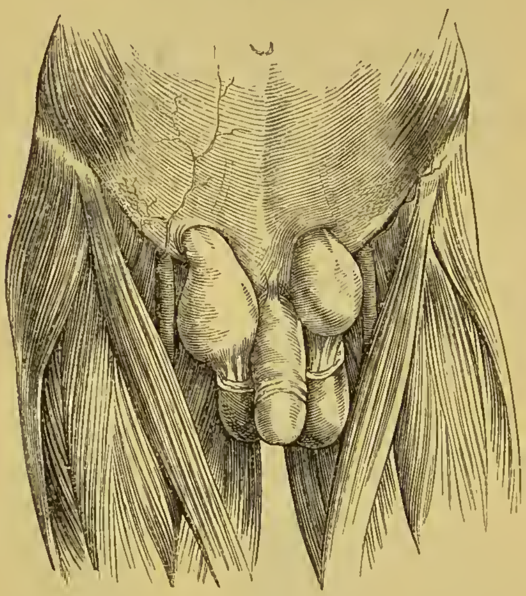
Fig. 198.



2. DIRECT INGUINAL HERNIA.

In explaining the anatomy of direct inguinal hernia, we shall follow the same order as in the former case. 1. The *commencement* of a direct inguinal hernia is opposite the external aperture, through which it comes usually by pushing the posterior wall of the inguinal canal before it, but in some instances by rupturing a part of it. 2. Its *direction* before leaving the aperture is directly forwards; after leaving it, it is the same as that of an oblique inguinal hernia in the corresponding part of its course. 3. The *coverings* of a direct inguinal hernia, from within outwards, are the hernial sac—the fascia transversalis with the conjoined fibres of the internal oblique and transversalis muscles, provided they be not ruptured—a very imperfect covering from the cremaster muscle—the external spermatic fascia—the superficial fascia, and the common integument. In the female, as there is no cremaster muscle, there is one covering less. These coverings differ from those of oblique inguinal hernia in two particulars—namely, that formed by the cremaster muscle is in this case less perfect; and the second from within outwards, instead of being formed by the internal spermatic fascia given off from the internal aperture of the inguinal canal, is formed by the fascia transversalis itself assisted by the conjoined fibres of the internal oblique and transversalis muscles, except when they have been ruptured, or separated from each other. 4. With regard to its relations to the inguinal canal, spermatic cord, and internal epigastric artery, we may remark that it does not come down through the canal, but directly through its external aperture; that the cord, instead of being behind it, is on its outer side; and that the artery, instead of being on the pudic, is on the iliac side of the neck of the hernia. This last peculiarity is most important to be remembered, and it is thus seen that oblique and direct inguinal herniæ have opposite relations to the internal epigastric artery. 5. The *seats of*

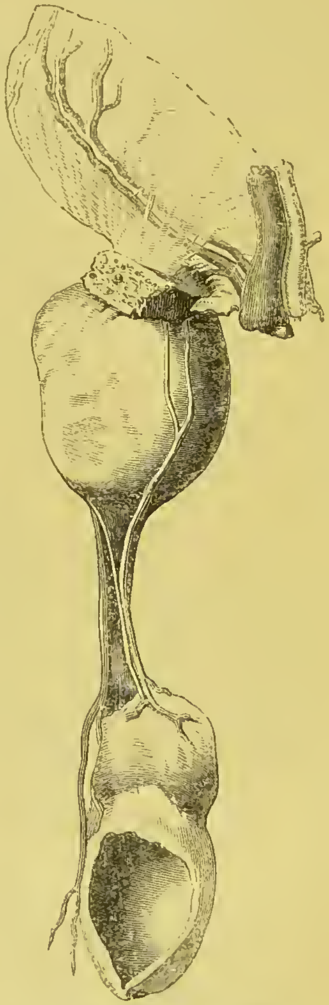
Fig. 199.



From Druitt.

stricture in this species are only two; namely, at the external aperture—which, however, is a rare occurrence, and then the stricture may be formed either by the circumference of the aperture, or by the hernial sac; and at the under border of the internal oblique and transversalis muscles, the stricture being formed by them, or by the hernial sac itself. 6. After what has been stated regarding the operation for strangulated hernia in general, and that for oblique inguinal hernia, it seems unnecessary to do more than add, that when the stricture is at the under border of the internal oblique and transversalis muscles, the knife in dividing the stricture could be carried directly upwards, or upwards and inwards, without going in the direction of the internal epigastric artery; but not upwards and outwards. It would be unsafe to cut upwards and outwards in direct inguinal hernia, or upwards and inwards in oblique; and as it is difficult or impossible in some cases to determine whether the hernia be oblique or direct, from the weight of the hernia having drawn down the internal aperture to be opposite the external, it is proper to adopt the rule already laid down—namely, in *all* cases of inguinal hernia, in dividing the stricture to cut directly upwards. It may be briefly stated, that the operation is performed by making an incision through the integuments in the direction of the tumour, and extending from its upper to its under part, and cutting through the other coverings until the hernial sac is brought into view. The hernial sac is then opened, strict attention being paid to the precautions before mentioned. The forefinger of the left hand is then introduced into the sac, and carried up to the stricture, and the palmar aspect of the finger used as a director for conducting the knife up to the stricture, and as a guard to prevent the knife from coming against the hernia. The extremity of the knife having been introduced below the stricture, its edge should be directed

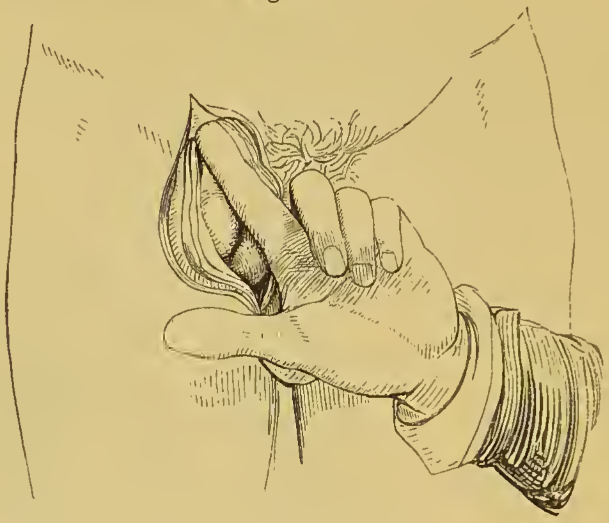
Fig. 200.



Drawing of the sac of a direct inguinal hernia; showing the mouth of the sac lying on the pudic side of the deep epigastric vessels, and the spermatic cord split so that its vessels lie behind, and the vas deferens in front of the sac. From a preparation in my own museum.

towards the stricture, and division effected by cutting directly upwards. The hernial contents should then be returned, if such a proceeding is possible and proper; if not, the treatment formerly described should be adopted.

Fig. 201.

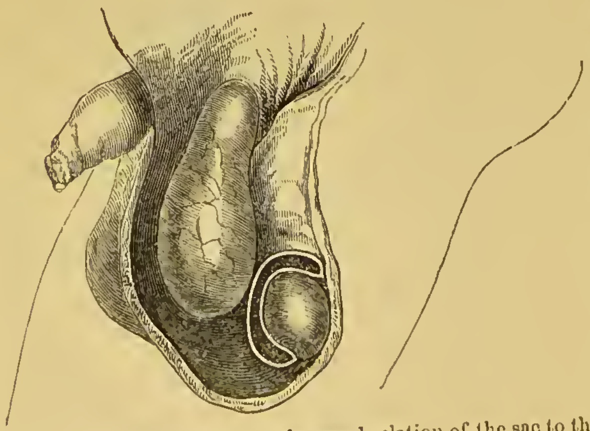


From Liston.

3. CONGENITAL INGUINAL HERNIA.

Congenital inguinal hernia—more properly called hernia into the tunica vaginalis, because while it is usually congenital, or met with in young infants, it sometimes, though rarely, presents itself at a more advanced age—differs from the two species already described, in that they, if they descend into the scrotum, are without, as is shown in the accompanying delineation, but this is contained within the tunica vaginalis. The two accompanying diagrams, though somewhat altered and improved, taken from the works of a writer, who was once a great ornament of the surgical profession, show the opposite relations of common and congenital inguinal hernia to the tunica vaginalis. The manner in which this species of hernia is formed, may be thus explained. Although the tubular

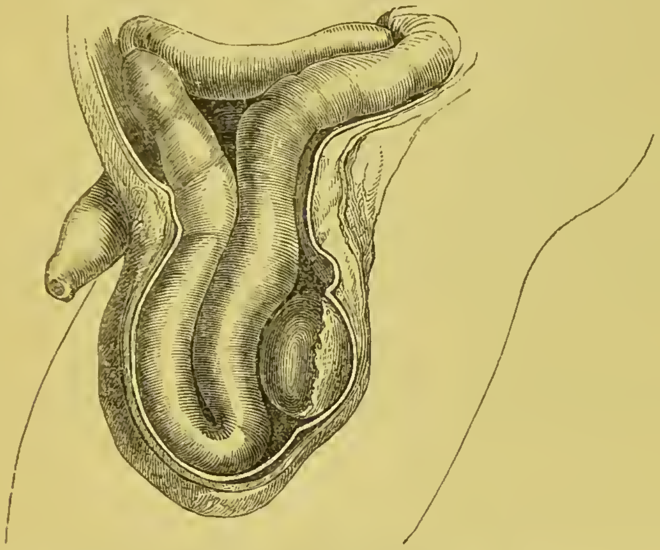
Fig. 202.



A scrotal hernia; showing the usual relation of the sac to the tunica vaginalis.

portion of peritoneum, which, for a short time after the descent of the testicle, forms a canal of communication between the tunica vaginalis within the scrotum and the peritoneum within the abdomen, usually becomes very soon occluded, and ultimately quite obliterated, so that the cavity of the tunica vaginalis is perfectly separated from that of the abdomen, yet in some cases the tubular portion does not exhibit its usual disposition to close and become obliterated, and while this state continues, on crying or making some exertion, a portion of intestine may be sent down through the tubular canal into the cavity of the tunica vaginalis, and thus constitute what is called a congenital hernia. As it is only after the inflation of the lungs that the usual exciting causes are applied, this variety rarely occurs till after birth; but sometimes a portion of intestine in contact with the testicle while within the abdomen, adheres to the testicle, and descends with it into the scrotum at the usual time at which the gland leaves the abdomen, and in such cases constitutes the hernia prior to birth. Congenital hernia is almost invariably formed of intestine alone; the omentum very rarely descending so far as the commencement of the tubular canal. The principal peculiarities distinguishing this from the two former species are, that it has no hernial sac of peritoneum proper to itself, the tunica vaginalis being its immediate investment and forming its hernial sac; that it is in contact with the testicle, which consequently cannot be so distinctly felt as in the more common species; that the whole swelling is more uniform and firm than in an oblique or direct inguinal hernia, and that the different parts are less easily felt and distinguished. Most of these peculiarities depend on that previously mentioned, namely,

Fig. 203.



Congenital scrotal hernia; showing the situation of the hernia within the tunica vaginalis.

its being within the tunica vaginalis, which is thicker and firmer than the peritoneum, which forms the sac in the more common varieties. The descent of this species is usually sudden and complete.

For this variety in its different states of reducible, irreducible, and strangulated, the same rules are to be followed as have been already laid down for the treatment of hernia in general. When it is found in adults, and becomes strangulated and requires an operation, the seat of stricture is almost invariably higher up than the external aperture, and the operation is more difficult than in oblique or direct hernia, from the parts being concealed and the parietes being thickened. The incision should not be carried further down than to within about three inches of the under part of the tunica vaginalis, because as that membrane has to be opened, if the incision were carried lower, the testicle would be unnecessarily exposed to irritation. In other respects the operation is the same as for oblique inguinal hernia.

An extremely rare form of hernia has been met with in the female, in which the protrusion is into the canal of Nuck, which invests the round ligament. It has been met with chiefly in children, and requires the same treatment as the corresponding disease in the male.

4. ENCYSTED CONGENITAL INGUINAL HERNIA.

This variety, which is still more rare than the former, has been more properly termed encysted hernia of the tunica vaginalis; for though, like the last species, it is within, yet it is not in contact with the tunica vaginalis, but is separated from it by a hernial sac. That the hernia is within the tunica vaginalis, and that it is contained within a hernial sac, there is no doubt. There has indeed been some difference of opinion as to the mode of formation of the sac, but it now seems nearly certain from various dissections that it is formed in one or other of the two following ways. If the tunica vaginalis remain open every way except at the abdominal canal, and if imperfect adhesions form at that point, and a hernia descend into the part above the adhesions, the adhesions becoming elongated and pushed down before the hernia constitute the hernial sac—the sac proceeding from, and adhering firmly to the tubular portion of membrane between the abdomen and the tunica vaginalis. Or, if the tunica vaginalis remain open everywhere except at one part, and be there imperfectly closed, the peritoneum being pressed down before the hernia into the tunica vaginalis will thus constitute a *serous* covering for the hernia.

5. HERNIA INFANTILIS.

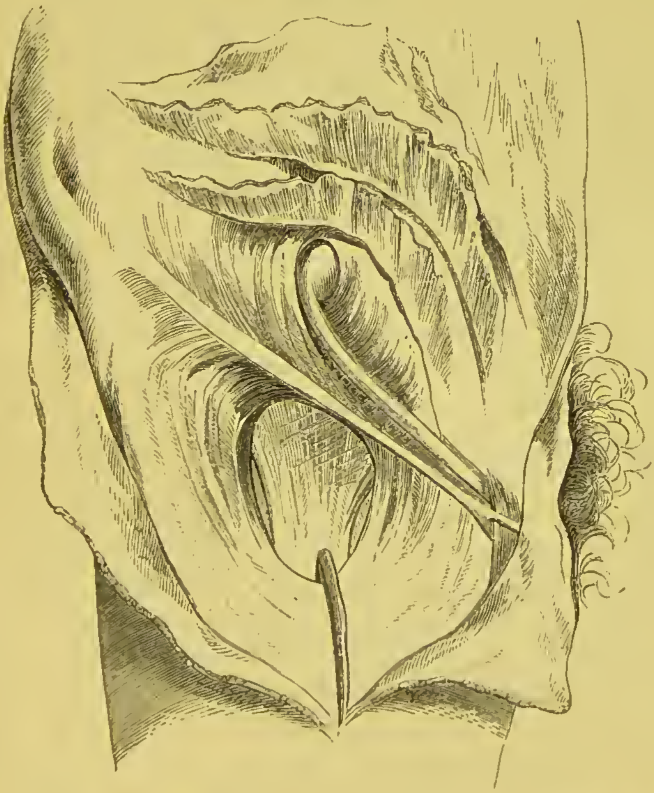
This term is applied to a very rare species of hernia, originating in early life, which may be said to consist of a hernia with the usual peritoneal sac placed behind the tunica vaginalis. The way in which it takes place may be thus explained. The cavity of the tunica vaginalis is unusually large, contains some serous fluid, and ascends high up in the cord, although its communication with the abdomen is occluded. The hernia, with the usual peritoneal sac, is sent down behind the tunica vaginalis, and in consequence, three layers of serous membrane, namely, the front and back of the tunica vaginalis, and the front of the hernial sac, must be cut through before arriving at the substance of the hernia.

II. FEMORAL HERNIA.

A hernia is called *femoral* or *crural* when the descent takes place behind Poupart's ligament, through what is termed the femoral or crural ring; which ring being much larger in the female than in the male, from the space being greater between the anterior superior process of the ilium and the pubes, femoral hernia, which is in the male a very rare occurrence, is comparatively frequent in the female. The nomenclature adopted in the following description, is that employed by some of our best writers on anatomy, who call the space in which a femoral hernia is situated, the femoral or crural canal, its upper extremity the femoral ring or abdominal extremity, and the other the saphenous opening or femoral extremity of the femoral canal.

Direction.—A femoral hernia may be said to have three peculiarities

Fig. 204.



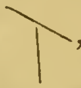
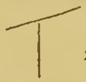
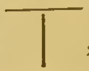
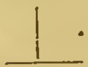
Drawing showing certain parts concerned in femoral and inguinal hernia.

of direction, namely, at first, and while within the femoral canal, downwards; on arriving at the saphenous aperture, forwards; and afterwards obliquely upwards and inwards; thus describing an arch, the convexity of which is downwards, and in a measure embracing three of the four aspects of Poupart's ligament—namely, the posterior, femoral, and anterior; the neck of the hernia being behind the ligament, the body on its femoral aspect, although removed a very little from it, and its fundus in front. These peculiarities suggest the necessity of straightening the hernia, or of bringing down its fundus, before efforts are made to return it by the taxis. The first change of direction is caused by the narrowing of the sheath, and its close adhesion to the vessels, together with the close adhesion of the iliac portion of the fascia lata to the front, and of the pudic portion of the same membrane to the back of the sheath at the under extremity of the femoral canal—conditions which, by producing constriction, offer an obstacle to further descent in a perpendicular direction; whereas there is little to impede the passage forward through the saphenous aperture. The second change of direction is caused partly by the firm adhesion of the fascia superficialis to the front of the fascia lata, but chiefly by the pressure against the superficial epigastric vessels, by which the forward progress of the hernia is opposed, whereas they offer no obstacle to its passing upwards in front of Poupart's ligament.

Coverings.—The fascial coverings from within outwards are, First, The hernial sac, formed of peritoneum. Second, The subperitoneal cellular tissue which lines the femoral ring, or abdominal extremity of the femoral canal. This substance, called by some authors the septum crurale, is pressed down before the hernial sac, and, together with the aggregate of textures, which in the normal condition occupy the femoral canal, constitutes the second covering. This covering is by some named the fascia propria,—a term applied by others to the third covering, consisting of the fascia infundibiliformis, or sheath of the femoral vessels, within which the hernia descends. The two last-mentioned coverings are, in many instances, so matted together as to form but one. Fourth, The layer of cellular tissue which spreads over the saphenous opening, and which is perforated by various vessels. This is by some called the cribriform fascia, and considered, I think properly, as the deep layer of the superficial fascia; whereas it is described by others as the middle division of the fascia lata. Fifth, The superficial fascia with some absorbent glands and adipose tissue; and, sixth, The common integument. There are great varieties with regard to the thickness of the coverings, and it is supposed that in some instances the hernia escapes through some of the openings in the femoral sheath and in the cribriform fascia, in which cases there will seem to be only two coverings interposed between the common integument and the hernial sac. I have been much struck, in my own operations, with the diversity in thickness of the fascial coverings, in different cases, and with the fact, that instead of six different membranes, constituting so many distinct coverings, as is the case in inguinal hernia, and as we might expect from contemplating the anatomy of the parts in the normal state, there are sometimes found only three; namely, the hernial sac; a cellulo-adipose layer, which varies much in thickness in different cases; and the skin. The greatest number, however, of fascial coverings which can present themselves, are the six enumerated above.

Anatomical relations of the Neck of the Hernial Sac.—The neck of a femoral hernia is related to the boundaries of the femoral ring as follows, namely, posteriorly, to the fascia iliaca, where it covers the linia ilia pectinea; anteriorly, to Poupart's ligament, lined by the prolongation downwards of the fascia transversalis; internally, to the base of Gimbernat's ligament, at the junction of the fascia iliaca and fascia transversalis; and externally to the femoral vein, from which it is separated only by the interposition of a membranous slip. There is also another relation which sometimes exists, namely, to the obturator artery, when that vessel, instead of coming off from the internal iliac, arises from the external iliac by a common trunk with the internal epigastric. When it has that irregular origin, the obturator artery crosses the femoral ring as it dips into the pelvis on its way to the obturator foramen, occasionally passing near to the posterior and iliac sides of the femoral ring, but much more frequently in front and towards the pudic side. In the latter case, if a hernia be present, the artery will embrace about two-thirds of the circumference of the abdominal aspect of the neck of the hernial sac, namely, the front and inner aspect; so that when the stricture is found at the femoral ring, great caution should be used not to make too extensive a division, or to send up the cutting edge of the instrument farther than is indispensable for dividing the tissue which constitutes the stricture.

Seats of Stricture.—This is a subject on which much attention has been bestowed; and although in some points a difference of opinion exists, it is certain that the stricture may be at the femoral ring, the textures constituting the ring forming the stricture; or at the saphenous extremity of the canal, and formed by the crescentic border of the fascia lata; or at the neck of the sac, and formed either by the sac itself, although this is comparatively rare in femoral hernia, or by the thickened textures around the sac. In my own operations, I have invariably found the stricture at the femoral ring, and the majority of authors agree, that it is found there more frequently than elsewhere; but it is certain that it is sometimes found in the other situations mentioned. In some instances, a stricture has been found at more than one of the above sites at the same time. Such are the usual seats of stricture, and the constituting textures in this species of hernia; but in some rare instances strangulation has been found to be occasioned by a loop of intestine, by a band of omentum, or, which is an extremely rare occurrence, by the circumference of an unusual opening in Gimbernat's ligament.

The *Intra-peritoneal operation.*—The body having been properly placed, the first step of the operation consists in making the integumental incision, various forms of which have been adopted, some making a simple incision, which is not the most convenient; some a crucial, which is objected to, as the under part of the vertical portion might interfere with the vena saphena major; some an incision, composed of two parts, the one oblique and in the course of Poupart's ligament, the other extending down from the former in a vertical direction, so that the incision is formed thus , on the right side, and thus , on the left; others making an incision thus , and others adopting the same form inverted, thus . The last-mentioned form is convenient, and may be made without risk of wounding important parts underneath, by transfixing the skin after pinching it up, the vertical portion extending from about an inch and a half above the crural arch, in a line with the centre of the tumour; and being met below by the transverse portion, which should go from one side of the tumour to the other, parallel to Poupart's ligament, but a little below it. The next step is to cut through the various coverings, and lay open the hernial sac. This having been done, and the fore-finger of the left hand introduced within the sac, and carried up in front of the hernia, and the seat of the stricture ascertained, the hernial knife, with its blunt point, should be carried up flat upon the finger, until its point be within the stricture, when its edge should be directed against the stricture, and the necessary division effected, by cutting directly forwards. Great care should be taken not to lacerate the intestine by the introduction of the finger, or to allow it to come against the edge of the knife, or to admit the knife farther than is absolutely necessary for the division of the stricture, lest the unusual disposition above mentioned of the internal epigastric artery should exist, and the edge of the knife should reach the artery. The remaining parts of the proceeding should be regulated by the principles laid down in the description of the operation in general.

By the above proceeding, the usual operation in which the sac is opened may be accomplished with as little difficulty and risk as by any other; but it may be proper to add, that, as regards the direction in which the stricture is divided, the modes adopted are very various. If the stricture be at the saphenous opening, there is no particular danger to guard against, and the surgeon may, in dividing the stricture, cut upwards and inwards, directly upwards, or upwards and outwards, and the operation is comparatively easy; and when it is at the femoral ring, the knife may be safely carried to a small extent inwards, into Gimbernat's ligament, upwards and inwards, directly upwards into Poupart's ligament, or upwards and outwards; but not directly outwards, on account of the femoral vein. The cutting inwards into Gimbernat's ligament has been recommended by Mauchart, Richter, Gimbernat, Boyer, Roux, Hey, Lawrence, and Ferguson, and others have objected to it, because it is more difficult, from the greater depth to cut into Gimbernat's than into Poupart's ligament; because there is, from the same reason, greater danger of cutting or tearing the intestine when endeavouring to get at the seat of the stricture, and also because so little additional room would be gained by the division of Gimbernat's ligament. The cutting upwards and inwards, recommended by Heister, Le Dran, Sabatier, Lassus, Chopart, Desault, and others, has been objected to on the ground, that if the hernia be in the male—which, however, is a comparatively rare occurrence—the knife is carried in the direction of the spermatic cord: but this danger seems to have been greatly exaggerated; for the knife ought never to be carried so high as to endanger the cord in the male, or the round ligament of the uterus in the female. The direction of the incision adopted by Pott, Sir Astley Cooper, and many others, was directly forwards, that by Mr. Liston forwards and a little inwards. Sharp cut upwards and outwards; and so did Dupuytren, but by a very different proceeding; he carried the knife from within outwards, and from below upwards; and although in this method the edge of the instrument is no doubt carried in the direction in which the epigastric artery is found, there is no danger of the artery being wounded, as the knife is not carried so high as to be in danger of reaching it. Scarpa had recourse to multiple incision in the under border of the crural arch.

Extra-peritoneal operation.—Two varieties of the mode of performing the extra-peritoneal operation, or that of Petit, should be mentioned, namely, the methods of Luke and of Gay.

Luke's operation consists in pinching up a fold of the integument transversely, and transfixing it so as that the incision may fall perpendicularly over the neck of the hernia when the skin is replaced. By a few movements of the knife Poupart's ligament is brought into view. A hernial director should then be introduced under the ligament, and by the use of the hernial knife or probe-pointed bistoury, it may readily be divided in an upward direction, and in the majority of cases the hernia may speedily be returned. Sometimes bands of fascia in front of the hernia prevent return after division of the ligament. Mr. Luke recommends the surgeon in these circumstances to insinuate the nail of the fore-finger of the left hand under them from above, to carry the point of a probed bistoury along the nail with its blunt edge towards the sac, and to effect division by drawing the bistoury away towards himself,—a proceeding which, if properly performed, avoids all danger of wounding the sac or its contents.

Gay's operation, as formerly stated, consists in making a perpendicular incision, about an inch in length, over the inner side of the neck of the tumour, and after dividing the integument and superficial fascia, in sending up the front of the finger on the inner side of the hernia, in introducing on the finger a bistouri caché through the crural canal to the ring, in introducing it between the sac and the pubic border of the ring, and in dividing the stricture by making the blade project from its sheath towards the pubes. Should either of these proceedings fail, the sac can be opened, and the ordinary operation performed.

In cases where these excellent operations are suitable, either the one or the other should be preferred to the ordinary operation of opening the sac; and fortunately, in the great majority of instances of femoral hernia, the extra-peritoneal mode of operation is suitable, owing to the important fact that the stricture is generally without the sac. The difference in this respect between femoral and inguinal hernia is very remarkable, as the following statistics will show:—In 20 cases of inguinal hernia operated upon by Luke, it was necessary to open the sac in 13; whereas, in 30 cases of femoral hernia he only required to open the sac in 7. That it is the safer mode of operation is also satisfactorily proved. Of 84 cases in which Luke operated, the sac was opened in 25, and remained unopened in 59. Of the 25 in which it was opened, 8 died, whilst of the 59 in which it remained unopened, 7 died. Again, in 153 cases of Petit's operation, 36 died, and precisely the same number of deaths occurred in 77 operations by the usual method. It is therefore perfectly clear that, where suitable, this mode of operation should be preferred; and the greatest credit is due to the gentlemen who have so ably advocated and proved the merits of this proceeding. It is equally clear, for reasons formerly stated, that it is not suitable in a large class of cases; that it never can supersede the necessity of the ordinary operation; and that it is the duty of the surgeon to give the preference to the kind of operation suitable for the site of the stricture, and the condition of the parts within the hernial sac.

III. UMBILICAL HERNIA.

The cases of umbilical hernia have been variously arranged by different writers. Scarpa divides them into two classes, namely—the congenital, appearing in the infant at birth, and the adventitious, occurring at any after period: but a more convenient arrangement is that of Lawrence, who gives three varieties, namely—the congenital, which appears at birth; the hernia of children, which appears after the navel has been formed; and the umbilical hernia of adults.

Congenital variety.—The congenital variety is occasioned by an original deficiency in the formation of the umbilicus; it exists at the period of birth, and is therefore properly called congenital; it forms a tumour, conical in form, the contents of which are for the most part intestine sent into the cord between its vessels, the umbilical vein being usually above and the arteries below, or on either side. The external covering of the tumour near the base is composed of integument, but at a farther distance it is formed by an expansion of the substance of the cord, for the hernia is sent through the umbilicus into the cord. The cavity is lined by a small peritoneal covering.

The treatment consists in returning the hernia, and preventing a recurrence of the protrusion;—two points of the utmost importance to attain, as in the event of the hernia not being reduced, the separation which must ensue of the expanded portion of the cord which forms part of the coverings, would expose the patient's life to the greatest danger. The method usually adopted in this country to prevent reprotrusion is compression by means of the nice elastic band and pad now in use for the purpose. Another plan, to which reference will be made in the next section, is to use the ligature with compression.

THE UMBILICAL HERNIA OF CHILDREN.

In this, which is a very common species of umbilical hernia, the object of treatment is, to return the protruded parts, and to keep them in that condition until the contraction and subsequent obliteration of the umbilical ring prevents any future reprotrusion. The means adopted for this purpose is compression, or the ligature; the former is attended with less pain and risk, and has always been preferred by the great majority of British practitioners. The treatment by ligature was practised by Desault and Dupuytren, and has been thus described:—"The infant being laid on its back, and its head bent on its chest, and its thighs flexed on its pelvis, the surgeon reduces the hernia, retains it with his left forefinger, and with his right hand raising the parietes of the hernial pouch, he slides them between his fingers to make sure that no part remains in the sac. Being assured of this, his assistant makes several turns round the sac, at its base, with a waxed thread, each turn being well tightened and secured by a double knot. The tumour thus tied is enveloped in a bed of lint, maintained by a compress and bandage. On from the eighth to the tenth day the ligature falls off with the parts it has strangled and killed. A small ulcer results, which is soon healed. It is well for the child to wear a bandage for two or three months, the better to prevent a relapse." This mode of cure, however, has not gained the favourable opinion of the surgical authorities in this country.

UMBILICAL HERNIA IN ADULTS.

This is rarely met with in males, but more frequently in females. Pregnancy is one of its most usual exciting causes; hence its comparative frequency in females who have borne many children. In almost all cases of umbilical hernia in adults, omentum forms some part of the hernia, and to this has been attributed the fact, that in the greater number of instances in which strangulation occurs, the symptoms are less urgent than in most other species of hernia. An umbilical hernia may be reducible, irreducible, or strangulated; and in each of these conditions the treatment should be conducted according to the principles laid down in the general doctrines of hernia. The coverings are very thin, consisting merely of the cicatrix of the navel, the hernial sac formed of peritoneum, and the very thin layer of cellular tissue by which they are connected together. In performing the operation, it should be remembered that these coverings are often exceedingly thin, and that it is desirable when possible to avoid opening the sac. When the peritoneum becomes exceedingly thin and adherent to the skin, the covering is often found to present the appearance of being formed of only one layer. The integument may be divided by a longitudinal or any convenient form of incision, and the stricture may be divided by cutting upwards and to the left side.

IV. VENTRAL HERNIA.

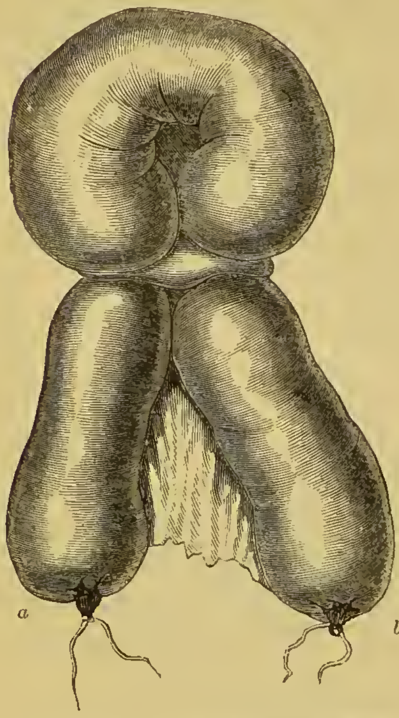
By a ventral hernia is understood one through any part of the front of the abdomen, except the inguinal canal, the femoral canal, or the umbilicus. Cases belonging to this class should be treated according to the general principles already laid down.

Such are the various classes into which herniæ in accessible situations are divided. Occasionally, however, they are found in inaccessible situations,—for example, in the diaphragm, the obturator foramen, or the greater ischiatic notch; constituting diaphragmatic, obturator, or ischiatic hernia. Sometimes cases occur of a mixed class; for example, a perineal hernia, which consists of a descent between the bladder and the rectum, the swelling presenting itself in the perineum; or a vaginal hernia, in which the tumour projects into the vagina Examples of hernia in inaccessible situations are, happily, of rare occurrence; and their existence only becomes a matter of certainty after death.

A diverticulum is sometimes the cause of fatal strangulation, of which a striking example is furnished by the following remarkable case published by me in the "Edinburgh Journal of Medical Science:"—David White, seventeen years of age, a fine-looking young man, had always enjoyed excellent health until the 22nd of April; on which day, while walking in the street, he was suddenly seized with sickness, vomiting, and violent pain in the abdomen; the pain being constant, but attended with frequent paroxysms of aggravation. At the commencement of the attack the belly was not tumid, nor was there any tenderness on pressure—on the contrary, the patient had an inclination to compress the belly with his hands, especially during the paroxysms of pain, and to turn himself round in bed. In the course of five or six hours, however, the abdomen became tender to the touch, and ultimately so much so that the slightest touch occasioned pain and vomiting; the belly gradually became tumid; and the patient was obliged to preserve his body as motionless as possible in order to prevent the aggravation of pain. Such is the history of the symptoms, as given by my friend, Dr. George Morrison, who attended him from the commencement of the attack. My colleague Professor M'Robin and I saw the patient for the first time twenty-four hours previous to his death. His symptoms, when we saw him, were—distension of the abdomen; constant violent pain, with paroxysms of aggravation like the tormina of ileus; tenderness on pressure; sickness, urgent vomiting of a greenish liquid; no stool after the commencement of the attack; pulse one hundred and thirty, small and feeble; features collapsed, and the countenance expressive of great exhaustion. These symptoms continued for twenty-four hours, without undergoing any material change, death taking place within sixty hours from the commencement of the attack. The suddenness with which the symptoms appeared, their history, and the absence of swelling in any of the usual sites of hernia, produced a strong impression on the mind of Dr. Morrison, Professor M'Robin, and myself, that the symptoms were caused either by intussusception, or by internal hernia, or by some internal cause of strangulation; in short, that it was a case of enteritis, occasioned by some internal mechanical cause.

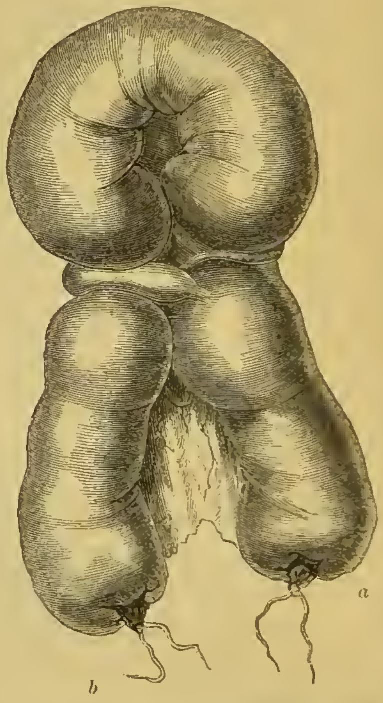
I made a post-mortem examination twenty-four hours after death, in presence of the medical gentlemen above mentioned. On opening the abdomen, a small quantity of sero-sanguineous fluid was found in the cavity of the peritoneum; the stomach and a great part of the small intestine were greatly distended with flatus; the distended portion of the intestine was much inflamed, and there were slight adhesions of lymph in some parts. The lower third of the ilium and the whole of the great intestine were collapsed, and of a perfectly healthy appearance. On displacing some of the convolutions of the small intestine, a portion of the ilium, twelve inches in length, was found greatly distended, strangulated, and in a state approaching to gangrene; the part of the intestine to the gastric extremity of the strangulated portion being violently distended and inflamed, and that to the rectal extremity being comparatively collapsed, and of a perfectly healthy appearance; the strangulation being effected by a diverticulum of the ilium, having very peculiar relations and connexions. Fig. 205 of the accompanying drawings gives a front view of the strangulated intestine and stricture. Fig. 206 gives a posterior view. Fig. 207 presents an appearance of the natural relations of the *diverticulum*, obtained after emptying the intestine, and withdrawing it from underneath the diverticulum by which it was strangulated. The diverticulum was an inch and a half in length, and terminated in a slightly-dilated cul-de sac, from the extremity of which a membranous band was sent off, one extremity of which was evidently continuous with the serous coat of the diverticulum, and

Fig. 205.



Anterior view of the strangulated intestine and stricture:—*a*, gastric extremity; *b*, rectal extremity.

Fig. 206.

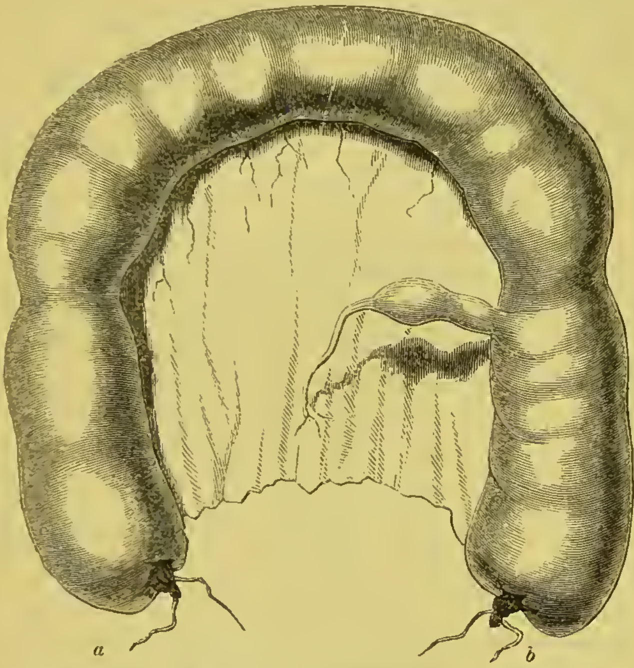


Posterior view of the strangulated intestine and stricture:—*a*, gastric extremity; *b*, rectal extremity.

the other as evidently not merely attached to, but becoming continuous with, the anterior lamella of the mesentery. Through the aperture formed by the diverticulum, mesentery, and the portion of the intestine from which the diverticulum is continued, twelve inches of intestine had passed at the commencement of the attack, and became strangulated. The above cannot but be regarded as a very curious and extremely unusual case—not that it is rendered so by the mere existence of a diverticulum, which is itself a rare formation, but the presence of a diverticulum being the occasion of strangulation. There is on record one case bearing a striking resemblance to the above. I allude to a preparation in the museum of St. Bartholomew's

Hospital, of which I subjoin the description as extracted from the published catalogue of that valuable collection :—"Portion of small intestine, from which a diverticulum is continued.—The extremity of the diverticulum is adherent to the contiguous part of the mesentery, so as to form a circular aperture or ring. Through this aperture a portion of intestine, twelve inches long, passed, and became strangulated. The patient, a lad subject to constipation, died four days after signs of strangulation of the intestine."

Fig. 207.



An appearance of the natural relations of the diverticulum to the intestine :—*a*, gastric extremity; *b*, rectal extremity.

It will, however, be seen that, in one point at least, the cases differ; in that of St. Bartholomew's Museum, the fundus of the diverticulum is adherent to the contiguous portion of the mesentery—whereas, in the case I have described above, the fundus of the diverticulum is connected with the mesentery by the serous coat becoming contracted into a membranous band, and expanding into the anterior lamella of the mesentery. In the catalogue of the museum of the Royal College of Surgeons in Ireland, there is a description of a preparation in which a diverticulum, four or five inches long, caused strangulation of several feet of intestine; but the relations of the diverticulum, as well as the mode in which it effected strangulation, were very different from the case described above.

CHAPTER XVIII.

INJURIES OF THE ABDOMEN, AND OPERATIONS.

WOUNDS OF THE ABDOMEN.

ALTHOUGH the doctrines respecting the treatment of wounds generally are applicable to wounds of the abdomen, yet as these are particularly dangerous, and require certain peculiarities of treatment, it is necessary to give an account of the sources of danger, and of the treatment required in wounds in that part of the body. There have been instances in which both the fixed and the floating viscera have been wounded, and in which balls and sharp instruments have passed through the body, and yet the patient has recovered; but still when wounds of the abdomen are accompanied by injury of the contained viscera, they are extremely dangerous, and in the majority of instances fatal. The chief sources of danger are *hemorrhage, fatal depression of the nervous system, extravasation of visceral contents,* and *peritonitis.*

1. *Hemorrhage* may prove fatal, either very speedily from the loss of blood, as when any large vessel in the abdomen is wounded, or when there is an extensive deep wound of such organs as the liver or spleen—such cases presenting the usual symptoms attendant on profuse internal hemorrhage; or, when the loss of blood is not of sufficient extent to produce death, by its occasioning inflammation of the peritoneum, which quickly leads to the most unfavourable results. —2. *Depression of the nervous system,* although generally attendant in a greater or less degree on wounds of the abdomen as well as on blows on that part, more rarely occurs to a fatal extent in the former than in the latter case; yet sometimes it terminates in death, the sudden shock given to the nervous system causing the failure of the heart's action,—a result which has been supposed by some to occur more frequently after injuries of the stomach and duodenum than of the other viscera.—3. *Extravasation of visceral contents* does not occur so often as might be expected; indeed, it is astonishing how seldom such effusion takes place in cases of a small wound of the intestine; extravasation being in such cases prevented, in the first instance, by the constant equable pressure which the abdominal viscera exert on each other, the various surfaces being constantly in close contact, and by the tendency to protrusion of the mucous membrane, which plugs up the orifice, and afterwards by exudation of coagulable lymph on the exterior of the wound, by which and by adhesion to surrounding textures the breach becomes permanently

repaired. By this process both hemorrhage and extravasation of intestinal contents are often prevented; but if the viscus be full, or the wound very considerable, effusion of visceral contents into the peritoneum is apt to take place; and if so, the result is certain to be fatal—for escape of bile, or of urine, from the great acrimony of these secretions, or of the contents of the alimentary canal, will produce the greatest possible suffering, which very speedily terminates in death. The most prominent symptoms in such cases are—sudden, unremitting, and excruciating pain, great prostration of strength, ghastly anxiety of countenance, extremely feeble pulse, and on the part of the patient, a decided conviction of approaching death.—4. *Peritonitis* is another source of danger, and one so common that it may be said to be the cause of death in almost all fatal cases of penetrating wounds of the abdomen, excepting those in which death takes place from the great and sudden loss of blood, or from the shock given to the nervous system, or from extravasation of visceral contents, in which death occurs so soon after the extravasation, and so little trace of inflammation is discernible, that it appears most probable that the fatal result was occasioned by the sinking of the nervous system.

For the clearer explanation of the principles to be followed in the management of wounds of the abdomen, it is convenient to arrange them into four classes.—1st, Wounds which simply penetrate the cavity without injuring any of its contents;—2ndly, Wounds which not only penetrate the cavity, but injure some of the contained viscera, without protrusion of the wounded part;—3rdly, Wounds attended with protrusion without any wound of the protruded part; and, 4thly, Wounds accompanied not only with protrusion, but also with injury of the protruded part.

1st. Wounds which simply penetrate into the abdominal cavity are the least dangerous; yet if the wound be extensive, there is risk of its giving rise to peritoneal inflammation. The great object of treatment, therefore, is to guard against this occurrence, for which purpose absolute rest and the sparing use of the mildest ingesta should be strictly enjoined, together with the best local treatment for procuring adhesion,—comprehending attention to position, the use of adhesive plaster for keeping the edges of the wound in apposition, and, if necessary, the interrupted silver suture. When sutures are used, special care is to be taken not to include the peritoneum in the suture. All judicious and available means should be employed to prevent inflammation, and if it should occur, appropriate remedies should be used to subdue it.

2ndly. Wounds which not only penetrate the cavity, but also injure some of the contained organs without protrusion of the wounded part are extremely dangerous. In many instances it is impossible to form an idea of the extent of injury received. The healing of the wound in the parietes should be promoted by suitable means, and as searching for wounded viscera would be contrary to all sound principles of surgery, the symptoms arising from the internal injuries can only be met by medical treatment. Important indications are, to guard against all exciting causes of extravasation either of blood or of visceral contents, and against all causes of inflammation; and if inflammation should occur, to endeavour to subdue it. It is, therefore, necessary to abstain from all imprudent exhibitions of stimuli for the removal of the collapse consequent on injury; to preserve the body at perfect rest in the horizontal position; to give a little barley-water and ice only for nourishment for a few days; to keep the patient fully under the influence of opium; and to abstain from the employment of purgatives, as being calculated to do the greatest harm, not only on account of the irritation they produce increasing the danger of the occurrence of inflammation, and its intensity when it does occur; but also, because by the additional peristaltic motion they increase the risk of extravasation of intestinal contents, and interfere with the process by which nature repairs the injury. These, with all the details of antiphlogistic regimen, constitute important parts of the preventive treatment, and when inflammation occurs, the remedies proper for that state must be promptly applied. If there be reason to suspect injury of the bladder, the catheter should be kept introduced to diminish the chances of extravasation of urine.

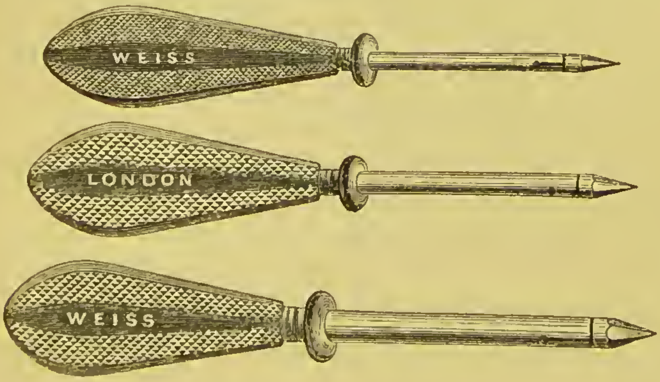
3rdly. Wounds attended with protrusion without injury of the protruded parts. The protruded parts are usually portions of intestine or omentum, or both; and if uninjured, the sooner they are reduced the better; but all proceedings for that purpose should be conducted with the utmost gentleness, so as not to induce the danger of inflammatory accession, care also being taken, as in hernia, to return that part first which was last protruded,—the mesentery before the intestine, and the intestine before the omentum. By these proceedings, the parts are more likely to resume their natural position in the belly, and there is less danger of exciting irritation and inflammation, than by attempting to return the whole *en masse.* For facilitating reduction, the patient should be placed in the most favourable position for the relaxation of the abdominal muscles; the pelvis should be slightly raised, and the chest bent a little forwards. The protrusion is always large when compared to the opening by which it escaped. The margin of the wound acts as a ligature, giving rise, owing to constriction, to a dull, livid, congested, and, if time be allowed, an inflamed and gangrenous condition of the protruded parts. Considerable difficulty is sometimes experienced in accomplishing reduction, in consequence of the protruded parts being thus congested, and the intestine becoming distended with flatus. Various proceedings have been recommended and adopted for overcoming this difficulty. Paré, Dionis, and many others advised the puncture of the intestine with a round needle to allow the flatus to escape; some recommend squeezing back the air into the portion of intestine within the abdomen; but the safer, and indeed, in my opinion, the only justifiable course, when necessary, is, instead of puncturing the intestine, or injuring it by undue and dangerous pressure or handling, to enlarge the opening very slightly. When such a step is absolutely necessary, the incision should be made at the upper rather than at the lower part of the wound, except when the incision in that direction might endanger the internal epigastric artery, or correspond with the umbilicus; and in all instances it should be as limited as possible. Of course, if by gentle and safe pressure the intestine can be reduced, or its contents be so returned as to admit of reduction, no judicious surgeon would venture on the use of the knife. The best instrument for enlarging the opening is the probe-pointed bistoury. It is an important precaution to make sure that the reduction is complete, lest if part of the protrusion be not sent into the cavity, but remain embraced by some of the textures forming the aperture, strangulation should ensue. It has happened in some cases where reduction was erroneously supposed to be complete, that the inner part of the wound had so embraced a portion of the protrusion, as to cause fatal strangulation. Immediate reduction, the greatest gentleness of proceeding, the avoiding all unnecessary and severe handling of, or pressure on, the intestine, the enlarging the aperture when absolutely necessary, the making sure that the reduction is complete, the retaining the parts in the abdomen by suitable treatment until the wound is completely healed, the decided influence of opium, giving only a few teaspoonfuls of barley-water or beef-tea for nourishment, a little ice to allay vomiting or thirst, and guarding by all judicious precautions against the occurrence of inflammation, are the most important points to be attended to in the management of the species of injury now under consideration.

4thly. Wounds accompanied with protrusion, and also with injury of the protruded parts. Since the special rules applicable to the management of wounds belonging to this class are precisely the same as those for the treatment of the cases of hernia in which the protruded parts are found, on cutting down upon them, to be in an unfit state to be returned into the abdomen, it is scarcely necessary to do more than refer to the section on that subject, and to that on the anatomy and treatment of abnormal anus. The following observations by Mr. Travers will be perused with interest:—"If a gut be punctured, the elasticity of the peritoneum, and the contraction of the muscular fibres, open the wound, and the villous or mucous coat forms a sort of hernial protrusion, and obliterates the aperture. If an incised wound be made, the edges are drawn asunder and everted, so that the mucous coat is elevated in the form of a fleshy lip. If the section be transverse, the lip is broad and bulbous, and acquires tumefaction and redness from the contraction of the circular fibres behind it, which produces, relatively to the everted portion, the appearance of a cervix. If the incision be according to the length of the cylinder, the lip is narrow, and the contraction of the adjacent longitudinal fibres, resisting that of the circular fibres, gives the orifice an oval form. This eversion and contraction are produced by that series of motions which constitutes the peristaltic action of the intestines." If the wound be very small, consisting of a mere puncture, and more especially if it be at a part of the canal usually not much distended, the most advisable course probably is to return the part, and trust to nature's process for closure; in short, the treatment is replacement without mechanical union. If the wound be incised, and small, and the intestine otherwise quite free from injury, the edges should be brought together by stitches of silk or fine thread introduced by means of a small round sewing needle, the edges being slightly turned inwards so as to have peritoneal surfaces in apposition. The ends of the silk should be cut off quite close to the knot, and the intestine replaced;—experiments on animals and experience in the human body proving that the small noose becomes bridged over with lymph, and finds its way into the intestinal canal by ulcerative absorption, and is voided with the fæces. Travers, Guthrie, and many others of great experience consider this the best mode of treatment in the class of cases now under consideration. Permanent closure of the wound, in cases which proceed favourably, is effected by the assistance of surrounding textures, to which the peritoneal coat of the bowel becomes adherent, by the exudation of lymph from the portion of peritoneum contiguous to that actually injured, and also from the peritoneal covering of surrounding coils and walls to which the peritoneal coat of the wounded bowel becomes adherent. "In order that this process may take place, it is necessarily of the first importance, that the movements of the bowels be paralyzed; and it is a beautiful provision of nature that the very provision that closes the wound arrests that peristaltic action, the continuance of which would interfere with its agglutination to, and closure by, the neighbouring parts. Until the necessary degree of inflammation to effect this is set up, the intestinal movements must therefore be arrested by opium." The external wound should not be very firmly closed at first, lest extravasation should take place, and the dressings should be as light as possible. In this variety the treatment consists both of mechanical treatment and replacement. If the wound be not very small, the most judicious procedure is to retain the cut portion at the surface of the wound by one or more stitches connecting the edges of the wound in the intestine with those of the external wound, and to endeavour to convert the case into one of abnormal or artificial anus:—replacement would be extremely injurious, by incurring the danger of extravasation of intestinal contents. It will be seen that, in the first of the three classes into which we have arranged wounds accompanied with protrusion and injury of the protruded parts, the treatment at first consists of replacement without mechanical union; in the second, of mechanical union and replacement; and in the third, there is neither mechanical union of the edges of the wound nor replacement, but the lips of the wound of the intestine are retained at the margin of the external wound, and the case is converted into one of abnormal anus, to avoid the danger of fatal extravasation into the peritoneum. In addition to the treatment for artificial anus formerly described, it is of the utmost importance until adhesions have taken place, to guard against all causes of extravasation, to give ice to check vomiting, to give only a few teaspoonfuls of gruel or cold beef-tea, and full doses of opium to subdue pain, stop peristaltic motion, to diminish the effects of shock, and to allay the anxiety of the patient.

PARACENTESIS ABDOMINIS.

The usual conditions which warrant the performance of this operation are, either ascites, or ovarian dropsy, when either disease arrives at so advanced a stage, that the pressure on the diaphragm creates a difficulty of breathing,—the object of the operation being to relieve the breathing. The most convenient attitude for the patient to be placed in is the sitting posture, on a chair, or on the side of a bed; and the preferable site for the operation is the linea alba, a little below the umbilicus. At one time the operation was performed in the linea semilunaris, but as there is danger there of wounding the internal epigastric artery, the former situation is to be preferred. In cases, however, of ovarian dropsy, the pointing of an ovarian cyst may render it necessary to select as the site of the operation the part where the bulging of the sac is perceptible. The patient having been placed in the proper position, and a broad bandage or sheet having been applied round the abdomen, and the ends committed to assistants for the purpose of drawing them to keep up pressure while the fluid is being drawn off, the surgeon introduces the trocar and canula

Figs. 208—210.



through the abdominal parietes in the linea alba, about midway between the umbilicus and the pubes, then withdraws the trocar, and when the fluid has escaped through the canula, withdraws it also. A piece of adhesive plaster is then placed over the wound, a compress above it, and the whole belly is tightly bound up by the bandage.

The bladder should be emptied before the operation, that there may be no danger of wounding it; and, while the fluid is being drawn off, constant pressure should be kept up by means of the bandage, lest dangerous or fatal syncope should result from the sudden accumulation of blood in the abdominal veins on the removal of the support previously afforded by the fluid; or lest, from sudden distension through the same want of support, either one of these veins, or some other vessel, should give way.

THE FORMATION OF AN ARTIFICIAL ANUS.

An insuperable mechanical obstruction of the bowels, situated in the rectum or colon, and placing life in imminent danger, is supposed to indicate the establishment of an artificial anus. The principal conditions which constitute such obstacles, and are thought to justify this operation, are, deficiency of rectum in new-born infants, when the malformation is such as to render it impossible to reach the bowel from the perineum, occlusion in consequence of malignant or other growths within or without the bowel, simple stricture, intestinal concretion, and insuperable obstruction from impacted fæces. Nothing would induce me to operate in cases of malformation in new-born infants, or of malignant diseases, because, if not unwarrantable, it is clearly unadvisable. On this subject I quite concur with Gross, who writes:—"I cannot, I must confess, appreciate the benevolence which prompts a surgeon to form an artificial outlet for the discharge of the fæces, in the case of imperforate anus in a child in whom the rectum is either completely absent, or terminates blindly several inches above its normal situation; or, in a case of scirrhus of the bowel in an adult, in whom, from the very nature of the disease, life cannot possibly be prolonged beyond a few brief weeks, or months at farthest." On the other hand, when any of the other conditions constitute the obstruction, the expediency of an operation should be urged upon the patient. In justice, however, to the opinions of some I greatly respect, it is proper, in a work intended to give an account of the present state of surgical opinion, to mention that many consider that for all the above-mentioned conditions, an operation for the establishment of an artificial anus should be ranked among the justifiable proceedings of surgery. Two distinct operations have been produced for establishing an artificial anus—the one the operation of Littré, and the other that of Amussat. Littré, in 1710, in a case of imperforate anus, proposed to open the sigmoid flexure of the colon in the left groin, and then to secure the orifice to the wound in the walls of the abdomen. The first operation, however, on this principle was performed by Pillore of Rouen, in 1776, in a man for the relief of complete obstruction, caused by a carcinomatous tumour of the rectum. The operation was on the right side, the part opened was the cæcum, and the man died in twenty-eight days, in consequence of violent inflammation of the jejunum, caused by the accumulation of a large quantity of metallic mercury taken previously to the operation. Douret of Brest, in 1793, performed the operation of Littré by opening the sigmoid flexure of the colon in a child two days old, the subject of imperforate anus. The patient not only recovered, "but when last heard from had attained the age of forty-two years." This is the first successful case on record of Littré's operation. Fine of Geneva, in 1797, opened the transverse arch of the colon, from the umbilical region, in a woman, for the relief of obstruction caused by scirrhus of the rectum. She died from the effects of the cancer in three months and a half after operation. In the operation of Littré, the parietal and visceral portions of peritoneum are divided; and hence the violent and fatal attacks of peritonitis which have sometimes resulted from this procedure. To avoid wounding the peritoneum at all, Callisen of Copenhagen, in 1796, proposed making a vertical incision, and opening the colon in the left lumbar region, where it is uncovered by peritoneum. He attempted to perform his operation on the dead body of a child, but failed to open the bowel without wounding the peritoneum, and the operation was in consequence condemned and abandoned on account of its difficulty. The celebrated Broussais was affected with scirrhus of the rectum, of which he ultimately died. Amussat informs us that while attending this distinguished man, he was led to reflect on the operations for insuperable obstruction of the bowels, that he made many operations on the dead body, with the view of determining the comparative merits of the different proceedings for establishing an artificial anus, that he became convinced that Callisen's operation, modified and improved, would be safe and satisfactory, and that, in 1839, an opportunity occurred of determining the merits of his operation by its performance on the living body.

Amussat's operation consists in making a transverse incision, about 4 to 6 inches in length, in the left lumbar region, from the outer border of the erector spina forwards, about two fingers' breadth above and parallel to the middle third of the crista ilii, dividing the skin, cellular tissue, and fat; in cutting through the external oblique, latissimus dorsi, internal oblique, and transverse, together with, in many cases, the anterior part of the quadratus lumborum muscle; in continuing the dissection through the cellulo-adipose tissue over the intestine, where the colon should be sought a little nearer the anterior than the posterior spinus process of the ilium, and in general will be readily found, and easily distinguished by its greenish hue, its distension, and fixed condition. Two ligatures should then be passed through the bowel, the one above, and the other below, for the purpose of steadying the bowel, drawing it forward to the surface of the wound before being opened, and to assist some additional stitches in fixing it to the edges of the wound after being opened. A small transverse opening should then be made in the posterior part of the bowel, where it is uncovered by peritoneum. The edges and corners of the transverse incision in the bowel should be carefully secured to the edges of the wound, and clearance of the bowel having been effected, the patient is placed in bed, and tepid water dressings laid over the wound. The utmost care must be taken during the operation not to wound the peritoneum, and also to prevent the escape of fæcal matters into the loose cellular tissue of the wound. There is very little hemorrhage; and one of the advantages of Amussat's operation over that of Callisen's is, that the danger of hemorrhage is less, owing to the incision being transverse in the former, and vertical in the latter.

Appreciation of Littré's and Amussat's operations.—For much interesting information, and, indeed, for an account of almost all that is known regarding these operations, I refer the reader to an admirable paper by Mr. Cæsar Hawkins, in which he gives an account of 48 cases, and also makes instructive references to the writings of Amussat, Pring, Maitland, Teale, Evans, Baker, Clement, and others, on these operations. He shows that the recoveries after Littré's operation were in the proportion of 41 per cent., whereas after Amussat's they amounted to 61 per cent.; that of 10 cases on the right side, in 4 Littré's operation was performed and all died, and of the remaining 6, in which Amussat's operation was performed, 4 recovered, showing that on the right side the lumbar operation should be performed; and that of 28 cases on the left side, in 8 operated upon by Littré's method 5 recovered and 3 died, and that in 20 cases in which the operation of Amussat was performed, 11 recovered and 9 died, from which it is clear that the operator in operating on the left side, is justified in making a selection of the site for operation. In some of the cases the operation was delayed until there was scarcely ground to hope that benefit could accrue from it, and some, for satisfactory reasons, are excluded from the numbers compared, for the purpose of arriving at a correct estimate of the comparative merits of the two operations. The one operation has been referred to by the three names of Littré's, through the peritoneum, and in the groin. Some of its advantages are, that it is easy of performance, that the artificial anus comes to possess some sphincter power, and that the situation is favourable for the manipulation of a truss for preventing the constant escape of fæcal matter. Three names given to the other operation are, Amussat's, the extra-peritoneal, and lumbar operation. Some of its advantages are, " the peritoneum is uninjured, fæcal escape is not so directly in the way of sight, and touch, and smell, there is less risk of prolapsus of the bowel, and control of evacuation is more complete, indeed, a complete sphincter seems to form in the loins, rendering the occasional exhibition of aperients necessary. The objections are, this new sphincter is apt to exceed its office, rendering dilatation or fresh incision requisite to maintain potency of opening; and the site is not readily within reach of the patient for managing the pad, which requires to be worn carefully adjusted." After recovery from the operation, a small ivory plug, fixed to a truss or bandage, is useful for preventing contraction of the opening and escape of fæces at inconvenient periods.

OVARIAN DISEASE.

Different kinds of Tumours.—The ovary, like other organs, is liable to fibrous, cartilaginous, and other tumours, but the growths with which it is commonly affected are of a cystic character, and constitute the disease generally known as ovarian tumour, or ovarian dropsy. There are various forms of cystic disease which have their seat in the ovary, but the principal are unilocular, multilocular, colloid, carcinomatous, and stearoid tumours. The unilocular cystic tumour varies much in size, in the thickness of the walls of the cyst, and in the quantity and character of the contained fluid. The fluid is most commonly of a pale straw colour, of a viscid consistence, and contains a large proportion of albumen. Although the simplest form of the disease and the most amenable to treatment, it is comparatively a very rare variety of ovarian disease. The multilocular ovarian tumour is the most common, and may be said to constitute the majority of cases of ovarian dropsy. This form of tumour often attains an almost incredible size, and consists of almost innumerable cysts; an immense number of small cysts being developed in the interstices or dissepiments, and project into the cavities of larger ones. While the tumour is small, its diminutive cysts are all pretty much of the same size, but when the growth becomes large, there is remarkable diversity in the size of the cysts; and as a general rule, the large cysts are fortunately found in the upper and anterior portion, and near the surface. On this subject Dr. Simpson remarks:—"This development of the cysts in the superior and anterior aspect of the periphery of the tumour takes place in accordance with a general pathological law, viz., that the extension of a morbid growth—especially if it contains fluid—goes on most actively in the direction where it meets with least resistance to its increase from the normal anatomical structure of the body. The firm floor of the pelvis presents an unyielding obstacle to the growth of the tumour in a downward direction, so that the cysts at the lower part of the tumour having no room to become enlarged and extended, remain, in general, comparatively small and undeveloped; while the cavity of the abdomen, filled only by soft and mobile viscera, and closed only in front by the distensible abdominal muscular wall, affords free space for its enlargement upwards and forwards. In this direction, accordingly, the development of a dropsical or multilocular ovarian tumour chiefly occurs; and partly by the breaking down of the septa between cysts originally distinct, but more by the secretion into the cysts of a quantity of serous fluid or gelatinous matter, the cystic mass often finally ends in the formation of a single large prominent cyst, or of two or three prominent and predominating cysts, which then become more accessible to tapping." The colloid tumour is by no means rare; and, besides having other peculiarities, differs from the last type of this malady, in the cells which contain a gelatinous fluid not attaining any great size, and in all having a pretty equal amount of development. Carcinomatous tumours are by no means very common in the ovary, but when met with, they are generally of the medullary form, and rapid in their course. Fibrous cancer occurs very rarely in the ovary; and melanotic is also extremely rare, and almost never occurs without the same disease in other parts. The stearoid tumour is the rarest of all; it seldom becomes very large, the fluid is of a yellow, creamy appearance, coagulates very rapidly when drawn off, and the cyst presents on its interior quantities of hairs proceeding from a portion of skin developed in its interior, and sometimes bands containing teeth, portions of bone, and other formations. The hairs have the same structure as the hairs in other parts of the body, having distinct bulbous roots, and are sometimes joined to the lining membrane, and in others they are separated from the cyst, and are found floating in its contents. The teeth present on section the usual structure of cavity, bone, and ivory, and, like the hairs, are sometimes quite unattached, at others imbedded in a follicle of lining membrane.

Varieties of Relation.—Cystic tumours not only present remarkable differences of size, but also of connexion; being in some instances attached only by a slight pedicle, in some by a thick band to the broad ligament, and in others adherent by a broad base. In some instances the tumour is perfectly loose and moveable, in consequence of being attached only to the broad ligament; and in others it is adherent to surrounding organs, or connected with the walls of the abdomen. Before ovariotomy is ventured upon, it is of the utmost importance to determine if the tumour be adherent to surrounding parts. If the tumour be not adherent, during a full inspiration, as was remarked by Sibson, it becomes considerably depressed by the descent of the diaphragm; it is moveable by a change of the patient's posture, its position can be changed by digital pressure; and, if the patient be placed on her back in bed, and desired to raise up her trunk without using her arms, the recti muscles, as was pointed out by Bird, will start up into a prominent band, if the sheath is not bound down by its peritoneal covering to the front of the tumour.

Grasping the abdominal wall, and trying to raise it from the tumour, the existence or not of crackling under the abdominal wall during respiration, and finding the uterus floating on the introduction of the sound, will assist in arriving at a correct conclusion regarding this important point. The conclusive test, however, is a small incision and exploration with the finger; but this ought never to be ventured upon, except on commencing ovariotomy after the most careful investigation ending in the conclusion that an operation is justifiable.

Symptomatology and Diagnosis.—For full information on these important subjects, we must refer the reader to obstetric authors, as the limits of this work will not admit of their satisfactory discussion. I may state that our reliance for diagnosis must be almost entirely on physical signs; that tumours of the ovary are most likely to be confounded with ascites, the gravid uterus, retroverted unimpregnated uterus, and enlargement of the omentum, liver, or spleen. In ascites, the swelling is more uniform, the fluid occupies the most dependent part, percussion yields a dull sound in the hypogastric region, and a clear one in the umbilical and epigastric; from the small intestines, the colon, and stomach occupying the last-mentioned regions, fluctuation is more readily detected, the general health is more affected, and generally there is anasarca of the lower extremities. In ovarian dropsy, the shape and outline are less regular, there may be no tympanitic sound if the tumour be large, the general health is less affected, the limbs seldomer anasarcous, but the veins are frequently varicose, which they rarely are in ascites. When tapping is performed, the character of the fluid removes all doubts as to diagnosis. From pregnancy the sure guides for diagnosis are, the history, the absence of the ordinary signs of pregnancy, but more particularly the absence of the sounds of the fœtal heart and of the placental bruit, and also of *ballottement*, on making vaginal examination. From retroverted unimpregnated uterus, and from tumour of the uterus, the diagnosis is made out by the aid of the uterine sound. In retroversion of the uterus, the sound passes backwards, and on raising up the uterus, the tumour in the pelvis disappears. In ovarian tumour, the sound passes upwards and forwards behind the pubes, and while the uterus is fixed by the sound, the ovarian tumour remains moveable.

Causes of Death.—The principal ways in which these tumours conduct to death, are by inanition, or by inanition and irritative fever, impeded respiration, hectic fever, a low grade of inflammation set up in the cyst after tapping, bursting of a cyst into the peritoneum, which is usually a cause of death, and sometimes a method by which nature effects a spontaneous cure. The principal causes of death, however, are the results of pressure, exhaustion, hectic fever, or some low type of inflammation, the last-mentioned condition sometimes occurring in consequence of tapping. There are great differences as to the period at which death takes place. A lady, a patient of my own, has had an immense ovarian tumour for thirty years, and for twenty-six years it has been perfectly stationary; another patient of mine has been the subject of this disease for fifteen years; and neither of these patients has been tapped. Some die in a few days after the first paracentesis, many within the first year, more die within the five years than live beyond that period, and few live beyond eight years after the first tapping.

Treatment.—There is no reason to believe that medical treatment is of any avail for curing or retarding the progress of this disease; that mercury or iodide of potassium do anything but harm; that any ovarian cyst with relation to its own fluid possesses anything but a secreting power; or that by means of diuretic, drastic, or other medicines, resorption can be promoted. Improvement of the general health is all that can be accomplished by medical treatment in this discouraging disease. There are many methods of treatment which differ from each other, but are all conducted on one principle, namely, that of causing gradual contraction and cohesion of the walls of the cyst; but, unfortunately, these proceedings hold out no prospect of benefit except in a rare class of cases, namely, where the sac is unilocular. Incision of a portion of the walls of the cyst, establishing a fistulous opening from the vagina, or through the abdominal wall, subcutaneous incision of the cyst for the purpose of allowing its contents to escape into the peritoneum, from whence resorption may take place, and tapping followed by pressure, are all proceedings founded on this principle. The application of galvanism by causing the current to pass through acupuncture needles introduced through the cyst, with the view of changing the action of the cyst, and destroying its secreting power, or of coagulating its contents, has been abandoned by some who thought this treatment worthy of trial; and the proposal of Tanner, in cases of extensive adhesions to tap the tumour, and where it is impossible to remove the cyst, to ligature the pedicle, in the hope of preventing the secretion of fluid, appears to me a proceeding of very questionable propriety.

Tapping is the simple mode of palliative treatment, and of procuring relief from the pressure of symptoms; but this simple operation should not be ventured upon until the swelling, by its size, is impeding respiration, or causing vomiting or suppression of urine, by pressure on the stomach or kidneys, or some other kind of suffering. As fatal peritonitis sometimes follows paracentesis, great exhaustion very frequently, and almost always rapid re-accumulation of the fluid, the operation should always be delayed until imperatively called for. The mode of performing paracentesis has already been described.

Two methods of radical cure have been successful in many cases; and too much praise cannot be awarded to the gentlemen who, by their skill and boldness, have demonstrated the success of these methods. The one is tapping and injecting the cyst with iodine; the other the operation of ovariotomy.

1. *Injection of iodine.*—M. Boinet first practised the injection of ovarian cysts with iodine, and the operation has been frequently performed on the Continent and in this country, and very considerable success has resulted. Simpson, Wells, West, Hutchinson, and others, have cured cases by this proceeding. The following particulars are important:—

Cases suitable for operation.—Nothing can be more important than the judicious selection of cases. Palliative paracentesis, injection of iodine, and ovariotomy should all be avoided where any degree of inflammation has been set up, although in the first instance in which iodine was injected the cyst was chronically inflamed, and the desired result was at last obtained. It should not be resorted to where the disease is multilocular; for although Boinet has great faith in the possibility of curing even this form of the disease by repeated injections, yet death has not unfrequently been the result of the practice in this class of cases. It should also be avoided when the cyst cannot be thoroughly emptied, as the iodine causes coagulation of albuminous secretions, and the numerous solid formations would act like foreign bodies, and cause inflammation in the ovarian cyst. The cases for which it is suitable, and in which it has been perfectly successful, are those in which the disease is unilocular, where palliative paracentesis has been done once or oftener, where there is no inflammation, and where the sac can be completely emptied. The existence of adhesions constitutes an obstacle to ovariotomy, but by no means counter-indicates this mode of treatment.

Mode of operating.—As correct diagnosis is extremely important, the surgeon should be provided with Hewitt's exploring trocar and sound, by means of which, if necessary, the interior of the cyst may be examined leisurely and carefully without the escape of fluid in the meantime. The patient having been placed on her side at the edge of the bed, the fluid being completely drawn off in the ordinary way, the operator places his finger on the canula to prevent the entrance of air, and by means of a syringe, or, as proposed by Simpson, a long glass tube capable of containing ten or twelve ounces of fluid, the injection is thrown into the cyst. The patient is then to be turned on her back, or the other side, and by this change of position and gentle manipulation with the hand, complete contact of injection with the whole of the interior of the cyst is secured, when the whole of the fluid should be withdrawn, and the wound covered with a little lint and a few bits of plaster as after ordinary tapping. Dr. Simpson uses the tincture of iodine of the Edinburgh Pharmacopœia, and Mr. Wells prefers a solution of twenty grains of iodine and thirty of iodide of potassium to an ounce of distilled water. It is to avoid the absorption of alcohol, to which some have attributed some subsequent ill effects, that Hutchinson and Wells prefer cauterizing the lining membrane of the cyst with the aqueous solution.

Results.—At a discussion on this subject at the French Academy of Medicine, Velpeau stated that out of 139 cases, there were 30 deaths, 63 perfect cures, and in 36 the fluid returned. In 20 of the fatal cases, the dangerous practice was instituted of maintaining an opening in the cyst by keeping a tube in the wound. Boinet reports 45 cases. Of these 36 were of unilocular cysts, of which 31 were cured and 3 died; and of 11 compound cysts there were 5 failures and 6 deaths. West operated in 8 cases, and of these 4 were cured, in 2 no benefit, and not one was fatal. Simpson and Wells have been very successful in the cases in which they have operated; but I have not seen a numerical statement of their cases with the results.

OVARIOTOMY.

The cases suitable for ovariotomy are those in which the tumour is multilocular and free from adhesions; where the patient is free from organic disease of other organs, and the general health in no respect incompatible with the performance of a capital operation; where tapping and other measures have totally failed to arrest the progress of the disease; and where nature has not established a fistulous communication, and the disease, instead of having become stationary, is marching on its usual course. In such a combination of circumstances, after making a candid representation of the dangers of ovariotomy, if the patient should then desire to have the operation performed, and be willing to run all risks and to jeopardize life to have the chance of its being prolonged, I consider that the surgeon need no more doubt his warrant to perform ovariotomy, than he would do the propriety in suitable circumstances to perform any of the other great operations of surgery.

The mode of performing the operation.—The patient having been placed in an easy position, with the shoulders a very little raised, on a suitable table, so situated that the light falls conveniently, chloroform having been administered, the surgeon standing on the right side of his patient commences the operation by making an incision with a scalpel or bistoury in the linea alba, from the umbilical region to the pubes, dividing the abdominal walls down to the peritoneum, which is first punctured, and then divided with a probe-pointed bistoury. At one time there was a difference of opinion as to whether the incision should be long or short; some believing that the danger of peritonitis would be increased by the long incision, and others, that the greater freedom and ease of manipulation, the diminished risk of laceration, and escape of cystic contents into the peritoneum, made the risk of peritonitis less in the operation by the long than in that by the short incision. Those of greatest experience in this operation have come to the conclusion that the free incision is certainly preferable, not only for facilitating the performance of the operation, but also for diminishing, for reasons now stated, the risk of peritonitis. The tumour then tends to bulge through the opening, and if there be no cysts of great size, or any adhesions to neighbouring organs, the tumour should be brought out through the wound; but if there be one or more very large cysts, it is advisable to tap them by means of a trocar and canula, the latter having an India-rubber tube fixed to its side, by which the fluid may be drawn off without wetting the patient or changing her position. If adhesions exist, they should be broken down by the finger or handle of the scalpel, it being so desirable to avoid any cutting, lest internal hemorrhage, which is one of the greatest sources of danger, should occur. The tumour having been brought out, and the pedicle divided, the great improvement suggested by Duffin, by which he has diminished the mortality of the operation, is generally adopted, namely, securing the stump of the pedicle without the lips of the wound; and in London the means used for that purpose is a clamp devised by Hutchinson, composed of two parallel gilded steel plates, with a screw at either end, and having their inner edges jagged, that the pedicle may not slip. The stump of the pedicle is received between the plates of the clamp, the plates are screwed together, and the clamp rests on the surface of the abdomen. It is placed transversely across the wound, and the stump of the pedicle is preserved without the abdomen. It is very desirable that there should be as little traction and displacement of veins as possible; and when there is found to be any danger of this traction Wells dissects up a small portion of the cyst, so as to make a pedicle sufficiently long not to keep a drag upon the uterus. Some of the former methods of performing this step of the operation were, tying the pedicle with a bit of strong whip-cord, or transfixing it, and tying each half as we do in strangulating internal hemorrhoids, and bringing the ends of the cord or ligatures through the wound. The presence of the cord or ligatures, and also of a sloughing stump of the pedicle, were fruitful sources of danger in this old proceeding. The wound is next to be closed, and one of the best modes of doing so is that recommended by Wells, namely, to use harelip pins or silver sutures, passing the pins or silver sutures through the entire thickness of the wound, including the peritoneum. The advantages of this proceeding are, that it brings the surfaces of the peritoneum together, admits of their becoming united, and thereby excludes from the abdomen any purulent matter secreted by other structures. Dr. Simpson suggests the propriety of stopping hemorrhage from the stump, and securing the pedicle without dragging by fixing it for fifty or sixty hours to the inner surface of the abdominal wall in front of the iliac fossa, by means of acupuncture needles. The edges of the wound are then brought together by silver sutures or harelip pins, without the stump of the pedicle being included between them, and by that proceeding the use of the clamp is dispensed with. In this method of operating, the pedicle must be fixed to the inner wall by the acupuncture needle before the pedicle is divided. My impression is, that the use of the clamp is preferred at present, as there has not yet been time to ascertain the results of this mode of fixing the stump by acupuncture needles.

After-treatment.—An arched frame should be placed over the abdomen; a light poultice, containing charcoal or some disinfectant, should be placed over the sloughing stump of the pedicle, so that the patient may not be annoyed by fœtid odour; and if the clamp be not used, light water-dressing may be employed, or what answers exceedingly well, certainly in many incised wounds in other parts, it may be left undressed, which Dr. Simpson considers is the preferable plan of local treatment. The patient should be kept perfectly motionless and quiet in an exceedingly well-ventilated room, with the air sufficiently moist; the strictest attention should be paid to hygienic measures, for they are of paramount importance; and opium should be given freely to check the effects of shock, to prevent pain, to keep the bowels from being moved, so that the parts may be kept at rest for some days, and to check feelings of sinking and depression. Ice should also be prescribed to allay thirst and sickness, and a few spoonfuls of barley-water, or arrowroot, or cold beef-tea should be allowed. If any feeling of sinking come on, brandy and wine should be given, the influence of opium maintained, and the case treated according to the approved principles of surgery.

Results.—Lyman of Boston has published a paper, to which was awarded the prize of the Massachusetts Medical Society, in which he gives an analysis of 300 cases. In 1, the result is not stated. Of 299, in which the result is declared, 179 recovered, and 120 died, or at the rate of 40 per cent.; of 208, in which the operation was completed, 119 recovered, and 89 died, or nearly 43 per cent. Out of the whole 300 cases, in 119, or 39½ per cent., was the operation successful in removing the disease and saving the life of the patient. Of 78 cases, in which extirpation could not be effected, 55 recovered from the operation, 22 died, in 1 the result is not stated. Of 88 cases, in which the operation could not be completed, the causes of failure in 68 were adhesions of the tumour, and of these 24 died. In 8, no tumour could be found; and in the remainder it was uterine, pelvic, or abdominal. The causes of death are given in 85 cases. Of these, 36 died of peritonitis, 20 of hemorrhage, 12 of exhaustion, 2 of shock, 2 of pneumonia, and 2 of diarrhœa. Dr. Clay of Manchester has been remarkably successful. Out of 87 cases he lost only 27, or about 1 in 3; and out of 31 of these cases he lost only 1 in 4; showing a most gratifying reduction of mortality. Mr. Wells stated at one time, that out of all the cases in which he had operated he had lost 37½ per cent., or 1 in 2⅔. Mr. Wells, however, has had the good fortune to reduce the mortality in a remarkable manner by improving his operation. He published in 1839 a paper giving an account of 8 cases, with remarks on the means of diminishing the mortality after this operation. Of these 8 cases, only 2 died. Since that time he has had 2 fatal and 2 successful cases. So that of 8 cases in succession, 6 recovered and 2 died; and of 12 cases, 8 recovered and 4 died. When the results of ovariotomy are compared with those of the great operations of surgery performed by the first surgeons, it is vain for any one to maintain that it is not justifiable to perform ovariotomy on account of the high rate of mortality after this operation. If the rate of mortality renders ovariotomy unwarrantable, then we must in fairness expunge from the list of justifiable proceedings in surgery many of the great operations we so much delight to perform.

History.—Professor Gross truly says, " The operation of ovariotomy is of American origin, having been first performed in December, 1809, by Dr. Ephraim McDowell of Kentucky." Previous to this period, the ovaries in the lower animals and in the human female had frequently been removed. In animals, they were removed to prevent breeding and promote fattening; in the human female, among some nations of antiquity, that some of their kings might have female eunuchs. Notwithstanding these and other circumstances, and the fact that Pott removed both ovaries contained in hernial sacs in the groins of a young female, and that L'Aumonier of Rouen, in 1776, in opening a pelvic abscess in the groin in a prostitute after parturition, found in the collection a body which he removed, and which turned out to be the ovary; yet in none of these proceedings was the operation the same, or undertaken with the view of removing a diseased ovary, and thereby saving the life of a patient; and although Morand, Plater, Vanderhaur, Delaporte, and some others, advised the removal of diseased ovaries, for the purpose of saving life, to McDowell the merit unquestionably belongs of performing ovariotomy with the same object in view as in the operation at the present day. He performed the operation thirteen times. His first patient recovered and lived 32 years after the operation. Of his 13 cases, 4 recovered, 2 were abandoned on account of adhesions, and the results in the other cases, as far as I am aware, are not known. The operation did not meet with adoption for many years, and it was not until it was taken up by the late Mr. John Lizars of Edinburgh, in 1823, that the operation excited much attention. He operated on 4 patients. Of these, 1 recovered, 1 died, in 1 the tumour was uterine, and could not be removed, but the patient recovered from the effects of the operation, and in 1 no tumour of any kind was found. Lizars seems to have abandoned his operation, and it was left to Dr. Clay of Manchester to revive this operation. Dr. Atlee of Pennsylvania soon followed his example,—Dr. Clay having operated in his first case in 1842, and Dr. Atlee in his first in 1843. Since the operation was thus revived, it has been practised and ably advocated by Wells, by all the distinguished men mentioned in this section, and others whose opinions my limits will not permit me to state.

CHAPTER XIX.

CALCULOUS DISORDERS.

Of the various morbid conditions of the urine, none are of greater interest to the surgeon than those in which various deposits take place. When a deposit is amorphous and impalpable, it is termed *sediment;* when it is crystalline, it constitutes *gravel;* and when concrete, it forms calculus or stone. The constitutional conditions which give rise to these deposits are commonly called *diatheses;* and of these the more remarkable are the three following :—

I. *The Lithic Diathesis.*—The lithic or uric acid deposit assumes one or other of three distinct characters; namely, that of amorphous and impalpable sediment, or that of crystallized sand or gravel, or that of massive concretions. The amorphous and impalpable sediment consists chiefly of lithic acid, in combination with ammonia. There are three varieties of this deposit, namely, 1, *The yellow sediment,* consisting of lithate of ammonia, more or less tinged with the yellow colouring principle of the urine; 2, *The red,* or as it is often called, the *lateritious sediment,* consisting of lithate of ammonia, combined with the yellow colouring principle of the urine and the red or purpurate of ammonia; and, 3, *The pink sediment,* presenting an appearance such as when the lithate of ammonia is combined with the red colouring principle, with little or no admixture of the yellow. Strongly marked examples of this last variety are extremely rare. The colour of the yellow sediment is owing to hematine, and of the red to a highly carbonaceous pigment, termed purpurine, met with in persons of a full habit of body, who live luxuriously. Urine containing lithates is clear when passed, becomes clouded on cooling, is very acid in general, and the sediment may be readily distinguished by its dissolving on the application of heat. The distinguishing peculiarity, however, of the uric acid and the urates is, that on adding a drop or two of concentrated nitric acid to a small quantity of the secretion containing them, and on evaporating it carefully over a spirit-lamp, a beautiful crimson tint is produced, termed murexide.

Crystallized sand or gravel consists of lithic acid with purpuric admixture, is of various forms and colours, according to the nature of the urine from which it is deposited. These crystals to the naked eye much resemble in size and shape the particles of Cayenne pepper, and in colour, when their presence is accompanied by fever, gout, rheumatism, or chronic disease of the liver, they are usually reddish;

when without fever, they more or less resemble the yellow amorphous sediment. The crystallized gravel, consisting of lithic acid, nearly in a pure state, differs from the lithates of ammonia in not being dissolved by heat. The calculi met with in this diathesis are of two kinds, the lithic acid and the lithate of ammonia; the former very common, the latter very rare, and met with chiefly in children.

Causes.—The tendency to lithic deposit is hereditary. It is usually found either in children and young persons under the age of puberty, or in persons from forty to sixty years of age. The principal exciting causes are, errors in diet, want of sufficient exercise, waste of tissues more rapid than the supply, as in fever, neglect to maintain a clean and proper state of the skin, and atmospheric influence. The habitual use of too much food, especially of animal food, the use of wines or malt liquors, or of any kind of food or drink calculated to produce an excess of hydrochloric acid in the stomach, a cold and moist condition of the atmosphere, or such a state either of the atmosphere or of the skin as tends to prevent the customary evolution of free acid or nitrogenized excretion through the skin, and certain cutaneous diseases, are favourable to the formation of lithic deposits. Free acid generated in the stomach passes off by the urine, and combining with an alkaline base precipitates the lithic acid. Prout remarks, "The lithic acid and its compounds we suppose to be principally derived from the albuminous principles, not only of the chyle and blood, but also of the albuminous textures of the body, in the same sense and mode in which we suppose urea and lactic acid to be principally derived from the gelatinous textures. When, on account of the imperfect assimilation of alimentary matters by the stomach and primary assimilating processes, the chylous principles are not raised to that standard of perfection by which they are fitted to become component parts of the blood, we suppose that the healthy kidney possesses the power of selecting and disorganizing such imperfectly developed chylous matters, and of converting them into lithate of ammonia. Such is the presumed origin of most of the *yellow* amorphous sediments occurring to healthy individuals from slight errors in diet, &c. During feverish or other derangements, in which the functions of the hepatic system are particularly involved, the lithate of ammonia is not only supposed to be derived from the imperfectly assimilated chyle, and the deteriorated albuminous principles of the blood; but also from the deranged secondary assimilation of the albuminous textures of the body. The lithate of ammonia thus developed appears in the urine more especially under the forms of the red and pink amorphous sediments; and is distinguished by the large quantities of colouring matters developed in conjunction with it. Lastly, the massive forms of lithic acid deposits are derived from the same sources as the above; but when thus deposited, the lithic acid is secreted, either in connexion with acids which combining with the ammonia of the lithates set the lithic acid free; or in connexion with other bases, as soda, &c., the compounds of lithic acid with which are less soluble than the lithate of ammonia."

Treatment.—Indolence and inactivity being predisposing causes of lithic deposits, exercise judiciously proportioned to the strength of the patient, and not sufficient to induce fatigue, should be strictly enjoined. The state of the skin should be attended to, and with that view bathing and friction are useful; the clothing should be sufficiently warm to prevent the natural and healthy perspiration from being checked, and, if possible, residence in a cold and damp situation should be avoided. Attention to diet is of the greatest importance; and in reference to this part of the treatment, the patient should be cautioned to avoid all kinds of food and drink which are indigestible, or calculated to excite acidity. Malt liquors of all kinds are injurious; wines, especially the sweet and acescent, and hard waters, should be avoided. Animal food should be taken but sparingly; and it is most important that the food generally be not only of the most digestible kind, so as not to excite derangement of the stomach, but also that it be taken in very moderate quantities. Besides attention to exercise, to the state of the skin, to the action of the liver, and to the careful regulation of diet, all which are important for diminishing the tendency to the occurrence of lithic deposit, it is advisable to administer alkalies for the purpose of preventing the formation of the lithic acid or of neutralizing it, and also for preventing its precipitation and the consequent danger of aggregation, by offering a soluble base for the acid. Of the different alkalies, potass is by much the preferable, as the salts formed by its combination with lithic acid are soluble; whereas with soda a salt may be formed as insoluble as lithic acid itself. Liquor potassæ in large doses after meals, will be found one of the most useful remedies for correcting this diathesis.

II. *Phosphatic Diathesis.*—This term does not imply the mere presence of the phosphates in the urine. In the healthy condition of that secretion, the earthy phosphates are eliminated from the body in a state of solution; but in certain states of constitution the balance of the healthy affinities is broken, and the phosphates become deposited in a visible form. To this condition is given the title of phosphatic diathesis. In the uric acid diathesis, the gravel precipitated is red, whereas in the phosphatic it is white. In the former, the deposit of lithate of ammonia is determined by an excess of acid; in the latter, by deficiency of acid, or alkalescence of urine. This class of deposits consists of,—1st, The triple phosphate of magnesia and ammonia, generally called the ammoniaco-magnesian phosphate; 2nd, The phosphate of lime, which is exceedingly rare; and, 3rd, Of a mixture of the two former. The three varieties are often referred to by the brief designations of—the triple, the calcareous, and the mixed, or fusible.

The earthy phosphates are readily soluble in urine healthily acid, and, therefore, an excess of them may pass off in acid urine without becoming visible; whereas the minutest quantity becomes visible in alkaline urine, on account of their not being soluble in alkaline fluids. Urine may be alkaline from the formation of a fixed alkali, such as the carbonate of soda, the carbonate of potass, or the alkaline phosphate of soda; but more commonly from the presence of ammonia, constituting what has been called ammoniacal urine, the ammonia being engendered by the decomposition of urea. Phosphate of magnesia is contained in healthy urine, but it is very soluble. If, however, ammonia be engendered, the triple phosphate of ammonia and magnesia which is formed is insoluble. This triple phosphate commonly occurs in the form of beautiful, brilliant, prismatic crystals, which sometimes float on the surface of the urine, and appear like an iridescent film of grease. Of the three deposits above mentioned, the first is the least formidable; the second, as has been already stated, is extremely rare; the third, consisting of a mixture of the two salts, is by far the most frequent, and is also the most formidable.

Causes.—The predisposition to the deposit of the earthy phosphates is inherited. The exciting causes act, some generally, others locally; the principal are, long-continued over-exertion, depressing passions, insufficient food, the habitual or long-continued use of debilitating medicines, such as mercury or strong purgatives, the abuse of the alkaline medicines, injuries of the kidneys, organic disease of the kidney, bladder, or prostate gland, and injuries or a morbid condition of the spinal cord. Any influence which unfavourably affects the body generally may be an exciting cause. It is well known that alkaline deposit is often found in consequence of injury of the back. On this subject an excellent authority remarks, "The immediate link in the chain of connexion between the cord and the urine in these cases, seems commonly to be a chronic inflammatory condition of the mucous membrane of the bladder, the decomposition of urea being effected by the altered mucus." Injuries of the spine favour alkalescence of urine by causing perversion of function in the kidney and in the mucous membrane of the bladder, and also by diminishing the expulsive power of the bladder. Retention of urine owing to such injuries, and to diseased prostate or any other cause, and crystals, however induced, cause no doubt an alkaline condition of urine, chiefly by decomposition, accumulation of mucus, and decomposition of urea; whereas the creating causes of alkalescence of urine that act generally, produce an alkaline condition of that fluid, principally through the intervention of a low form of dyspepsia and disorder of the digestive organs. When urine is alkalescent from a fixed alkali, no ammonia being present, then instead of the triple phosphate of ammonia and magnesia, the phosphate of lime is deposited, and commonly presents itself as a fine white amorphous powder, associated in general with mucus.

Symptoms.—The urine depositing the triple phosphate is generally abundant, pale-coloured, and of low specific gravity. That depositing phosphate of lime has been found in a few instances of a deep colour and acescent when passed, but is usually of a pale colour, of a low or moderate specific gravity, and becomes alkalescent sooner than healthy urine. That depositing the mixed phosphates, when unattended with disease of the bladder, is usually very abundant, of a pale colour, of a low specific gravity, and although it may be clear when passed, yet on being exposed to heat it becomes turbid from deposit of the phosphates; when connected with diseased bladder, it is usually alkalescent on being passed, and invariably becomes so on cooling; it also becomes very offensive, and with the phosphates deposits large quantities of mucus sometimes tinged with blood. Often, and especially in an advanced stage of the disease, the local and constitutional symptoms attending the phosphatic diathesis, resemble those of disease of the bladder, or of some other organic disease. The constitutional symptoms are subject to considerable modifications; but in all instances where the disease has assumed a permanent character, patients are cachectic, weak, sallow, languid, sleepless, and much affected with nervous irritability, which is evinced in many different ways. The bowels are flatulent and often irregular, and the peristaltic motion accompanied by borborygmi, and patients complain of a feeling of sinking and of pain and weariness in the back and loins on making the least exertion.

Treatment.—In this diathesis, the powers of life being in an asthenic condition, the treatment indicated by that condition is what experience has shown to be the most useful, and consists in the use of a generous animal diet, tonics, the mineral acids, such as the nitric or muriatic—both of which in many cases are given with great advantage—the due regulation of the bowels when absolutely necessary, by the mildest aperients, freedom from care and mental anxiety, and from every kind of exertion calculated to produce an unfavourable impression on the body, exposure to a free bracing atmosphere, and, together with these means, the use of sedatives, which are peculiarly indicated by the nervous irritability and anxiety with which patients in this state are so often afflicted. Of all remedies belonging to this class, opium is the most valuable, not only from its effects in relieving nervous irritability, but also from its power of rendering alkaline urine acid. In the severe forms of this disease opiates are absolutely necessary. Some have arranged the indications of treatment thus :—1st, To improve the condition of the digestive organs; 2nd, To acidify the urine; 3rd, To strengthen the system; and, 4th, When the deposit is caused by lesions of spinal cord, kidney, or bladder, to institute treatment for the existing lesion. The above are the principal indications of treatment; and when they are attempted to be fulfilled, the means must be modified according to the particular circumstances of individual cases. Saline draughts, alkaline medicines, saline or reducing purgatives, mercury, malt liquors, acescent vegetables, hard waters, and fruits, are injurious, and ought to be avoided.

III. *Oxalic Diathesis.*—In this diathesis, the preponderating unnatural ingredient in the urine is oxalic acid; and there is a tendency to the formation of calculus of oxalate of lime, or mulberry calculus, in the kidney, if a nucleus exist.

Symptoms.—The distinctive characters of the urine in this diathesis are, that it is remarkably free from sediment, often bright and clear, but sometimes of a pale citron-yellow or greenish hue, and of low or moderate specific gravity, and if condensed by evaporation, or examined by the microscope, the characteristic octohedral crystals are discernible. This diathesis is met with both in the young and the old; but the mulberry calculus is most commonly found in the middle period of life, and in the dyspeptic, and in persons of the sanguine and the melancholic temperaments. The constitutional symptoms vary exceedingly in character and degree, and in some respects are influenced by the peculiarities of temperament of the patients; those of the sanguine temperament being irritable, and those of the melancholic desponding and dejected; the mind having a great tendency to brood over the symptoms of the disease. Uneasiness is experienced during the assimilation of the food; flatulence is complained of, the symptoms of dyspepsia are often very troublesome, and in many instances the patient is annoyed by palpitation. When the diathesis is very marked, the skin in some cases assumes a peculiar hue. On this subject Prout says, "The skin is apt to assume an unnatural appearance, difficult to describe, but the colour of which may be said to vary from dull greenish-yellow in the sanguine, to dark olive or livid in the melancholic temperament." A nephritic attack occurs, and if the patient get rid of the calculus, he usually remains for years free from all his uncomfortable symptoms. The oxalate of lime calculus, which forms during the continuance of the diathesis, is hard, and bears a striking resemblance in form and colour to the mulberry, and is hence called the mulberry calculus. In some instances small calculi, consisting of oxalate of lime, are found, bearing so close a resemblance to hemp-seed, that they have been designated hemp-seed calculi. If they be not carried off by the urine, they pass into the mulberry calculus.

Although the mulberry calculus is not common, it is well known that small crystals of oxalate of lime are extremely common in the urine, and are discoverable by the microscope, although they do not sink or form a deposit. When examined with the microscope, they present two varieties; the one consists of beautiful, transparent, octohedral crystals, with sharp edges and angles, and the other shaped like dumb-bells. The former is comparatively common; the latter extremely rare. In slight cases there may be no local or constitutional symptoms, or none sufficiently marked to attract attention, the presence of the diathesis is then discoverable only by the microscope.

Causes.—Some of the exciting causes of this diathesis are believed to be grief, depressing passions, great loss of blood, and residence in a damp and malarious situation. It has been known to follow gout, and to accompany chronic rheumatism. Prout says, "Diet under all circumstances, but particularly in strongly predisposed habits, has, perhaps, more influence in exciting this diathesis than any other cause. I have seen repeated cases in which the too free use, or rather abuse, of sugar has given occasion to the oxalic acid form of dyspepsia; and sooner or later, under favourable circumstances, to the formation of an oxalate of lime calculus. I have also seen, as before noticed, well-marked instances in which an oxalate of lime nephritic attack has followed the free use of rhubarb, in shape of tarts, particularly when the patient has been in the habit, at the same time, of drinking hard water."

Treatment.—The treatment consists principally in attention to diet,—promoting the due performance of the functions of the digestive organs and of the skin, and in the observance of all judicious and proper means for maintaining the general health and strength. The diet should consist of animal and farinaceous food, and as the assimilating process is weakened, even those things which are proper should be taken in very moderate quantities, and in the lightest and most digestible form. The safest drink is distilled water. If, on account of the habits or condition of the patient, some stimulant should be necessary, brandy and water, taken with food, would be preferable to wine. The condition of the bowels must be carefully attended to, and, when necessary, regulated by the mildest laxatives; the function of the skin must be promoted by sponging, friction, and suitable clothing; and all causes of exhaustion or depression carefully avoided. Of medicinal remedies, the mineral acids, such as the nitric or the muriatic in some tonic infusion, and the nitro-muriatic in some bitter infusion, have been found of the greatest service. The effects of the mineral acids must be watched, and their use discontinued when they begin to produce a deposit of lithic acid, or of lithate of ammonia in the urine. On this subject a great authority expresses himself as follows:—"In cases of this diathesis, when the patient lives at a distance in the country, I commonly recommend the use of the muriatic acid, or nitro-muriatic acid, as the case may be, to be persisted in till the lithate of ammonia, or the lithic acid, begins to appear in the urine; or *for a month;* and by adopting such a course of acids three or four times in the year, and by a carefully regulated diet, I have seen the diathesis gradually subdued, and at length removed altogether." It is of the greatest importance for persons who have this diathesis, to abstain from sugar, fruits, fermented liquors, all kinds of viands containing oxalic acid, and especially the stalks of rhubarb, and from hard water. By partaking of food containing oxalic acid, and of hard water, which contains the supercarbonate of lime, they would be introducing into their system the very ingredients of the mulberry calculus.

FORMATION AND VARIETIES OF URINARY CALCULI.

Urinary calculi are formed on nuclei of their own substance, or on a clot of blood or mucus, or on some foreign substance introduced into the bladder by the urethra, or in consequence of a wound, or of ulceration. They may be either *renal* or *vesical.* The primary nucleus of a *renal calculus* may be constituted by the simple cohesion of the deposit, or by a clot of blood, or by a particle of the epithelium of the mucous membrane lining the cavities of the kidney—this last being a mode of origin believed to be not unusual after injury or inflammatory attacks of the kidney. The most frequent origin of a *vesical calculus* is the descent of a renal calculus, and its retention in the bladder. This in most instances furnishes the nucleus, which, however, sometimes originates in a drop of blood or of mucus. In some cases, calculi are formed on nuclei of their own substance deposited in the bladder; and in others, the nucleus is a foreign substance introduced into the bladder from without. In the great majority of instances, however, the nucleus is provided by the urinary organs themselves, and aggregation may go on at the original site of formation, or descent may take place into the bladder.

The following are the varieties :—

1. *The uric,* or *lithic calculus,* is generally oval, of a brown colour, varies in size from that of a pea to that of an orange, is composed of concentric laminæ, and is the most common of all calculi. Tests :—Consumption before the blow-pipe, solubility in caustic potass, and digestion in nitric acid leaving a scarlet residue, which becomes purple on being exposed to the vapour of ammonia.

2. *Urate of ammonia calculus* is confined to children, and extremely rare on account of this salt being pretty soluble in warm urine. On section it is seen to be formed of concentric layers. It is of a clay colour, and its fracture is earthy and fine. Tests :—The same as the last, with the addition, that ammonia is evolved during solution in caustic potass.

3. *Phosphate of lime,* or *bone calculus,* is rare, of a pale-brown colour, friable, laminated, and usually small, and of a spheroidal form. Tests : — Infusible, except at an intense heat, soluble in nitric or hydrochloric acid, and precipitated by liquor ammoniæ.

4. *The triple phosphate* is of a white or grey colour, may attain to a large size, is easily broken, and very imperfectly, if at all, laminated.

Tests :—Diminution and imperfect fusion under the blow-pipe, exhalation of ammoniacal odour, solubility in nitric or hydrochloric acid, and evolution of ammonia when treated by liquor potassæ.

5. *The fusible calculus*, consisting of a combination of the last two, is extremely brittle, white, and friable like chalk, and leaves a soft dust on the fingers. Tests :—It is readily converted under the blow-pipe into a pearly-looking glass, and is insoluble in caustic potass, but gives off ammonia.

6. *Oxalate of lime*, or *mulberry calculus*, is single, of a dark-brown colour, its density and weight are great, its texture is imperfectly laminated, and its form and size not unlike a mulberry. Tests :—Not soluble in boiling potass, soluble in nitric acid; if exposed to the blow-pipe the acid may be sent off, leaving quick lime, which, if moistened, reddens turmeric paper.

7. *The hemp-seed calculus* is a variety of the oxalate of lime, or mulberry calculus. They form in the kidney; they are of the form and size of hemp-seed, and usually pass off by the urine. When they are retained in the bladder they pass into the mulberry calculus.

8. *The carbonate of lime calculus*, rare in man, common in the lower animals. It is small, spherical, white, friable, and soluble in hydrochloric acid, with effervescence.

9. *The cystic oxide calculus*, so named from an erroneous impression that it is confined to the bladder, is extremely rare, of a yellowish-white colour, its fracture is compact, and exhibits a peculiar glistening texture, it exhales under the blow-pipe a peculiar odour like that of sulphuret of carbon, and is soluble in alkalies and mineral acids.

10. *The uric*, or *xanthic oxide calculus*, formed of a peculiar animal matter somewhat allied to uric acid, is extremely rare, of a cinnamon-brown colour, its surface smooth, its volume small, its texture compact, hard, and laminated. Tests :—It consumes before the blow-pipe, exhaling a fœtid odour, and leaving a white ash; it is soluble in alkalies and acids; the residue of solution in nitric acid evaporated to dryness is of bright lemon-yellow colour, and hence its name.

11. *The lithate of soda calculus*, but very rarely alone forms the whole of a calculus. It is white, soft, and friable; it is soluble in caustic potash with the assistance of heat; and when treated with diluted sulphuric or hydrochloric acid, the soda is separated, and by washing and filtration uric acid may be obtained.

12. *The fibrinous calculus*, of which, so far as I am aware, there has been but one case, in which small bodies of the size of peas, of a yellow colour, and composed of fibrin, were passed.

13. *The cystine calculus* is extremely rare, and differs from all others in containing a large quantity of sulphur—about 26 per cent. It has a peculiar yellowish-greenish or waxy appearance; it is composed of a peculiar animal substance called cystine; it is insoluble in acetic acid; it is soluble in alkalies, and in diluted hydrochloric acid; it is soluble in

ammonia, and when precipitated by acetic acid in the form of peculiar six-sided crystals.

14. *Alternating calculi* are by no means unusual; indeed, there are few large calculi which do not present more or less of the alternating character. Sometimes alternate layers of lithic acid and oxalate of lime are observed, and a phosphate layer not unfrequently coats a centre of uric acid or oxalate of lime. "The phosphates commonly succeed the other deposits, being surely produced after a certain time by the irritation of the mucous membrane, but the lithic and mulberry never coat the phosphates."

15. *The urostealeth calculus*, described by Heler, is the rarest of all; and it is not yet very certain that any example of it has been seen, except the specimens analysed by the German chemist, obtained from a man twenty-four years of age, whose chief complaint was pain in the right kidney. The concretions were from the size of a pea to that of a hazel-nut. When heated, they melted and emitted an odour like that of benzoin. Urostealeth is soluble in ether and caustic potass, and insoluble in boiling water, and nearly so in alcohol, and is believed to be composed of some kind of fatty matter.

Periods of life.—Stone occurs at all periods of life, from tender infancy to decrepit old age; and according to Stahl and Geyer, it occasionally exists as an intra-uterine affection. Of 5376 cases mentioned by Civiale, 1946 occurred before the age of ten; 943 from ten to twenty; 460 from twenty to thirty; 330 from thirty to forty; 391 from forty to fifty; 513 from fifty to sixty; 577 from sixty to seventy; 199 from seventy to eighty; and 17 after eighty. Coulson has collected 2972 records of cases of lithotomy; of these, 1466 occurred under ten years of age; 731 from eleven to twenty; 205 from twenty-one to thirty; 264 from thirty-one to fifty; and 306 above fifty-one years of age.

Numbers, size, and weight.—One is the most common number; but in upwards of one-sixth of all cases operated upon, several calculi have been removed. Cases of from two to six, or eight, are not uncommon. Sir A. Cooper, in one instance, removed 142, about the size of marbles. But the most remarkable case on record is that of an American judge, from whom Physick removed upwards of 1000 calculi, "varying in size from partridge-shot to a bean." The number of stones does not seem to add much to the patient's danger. The pressure on parts in the removal of one large stone is more to be dreaded than the removal of many small. The size of stones is very variable. Among the smallest stones removed is one of 10 grains, taken from a boy of thirteen years, and one of a few grains from a young man of sixteen, removed by Martineau. One of the largest stones, I believe, yet found in the human body, is in the museum of the Royal College of Surgeons of England. Mr. Clive made an unsuccessful attempt to remove it from Sir Walter Ogilvie. He died on the tenth day, and the stone was found to measure 16 inches around its long axis, and 14 inches around its short axis; and to weigh 44 ounces. Wytterhaven of Brussels removed a stone by the high operation, which measured 16½ inches in its longer circumference, and 12½ in its broadest. Deschamps saw one calculus that weighed 51 ounces; and Morand one that weighed 6 lbs.; but neither of these was removed. One of the largest removed is in Trinity College, Cambridge, and weighs 32 ounces. The largest stone removed successfully by Sir Astley Cooper weighed near 6 ounces. The smallest calculus I ever removed weighed 19 grains; and the largest I have removed with success weighed 4 ounces. The influence of the weight of the calculus, and the age of the patient, on the results of lithotomy, will be afterwards mentioned.

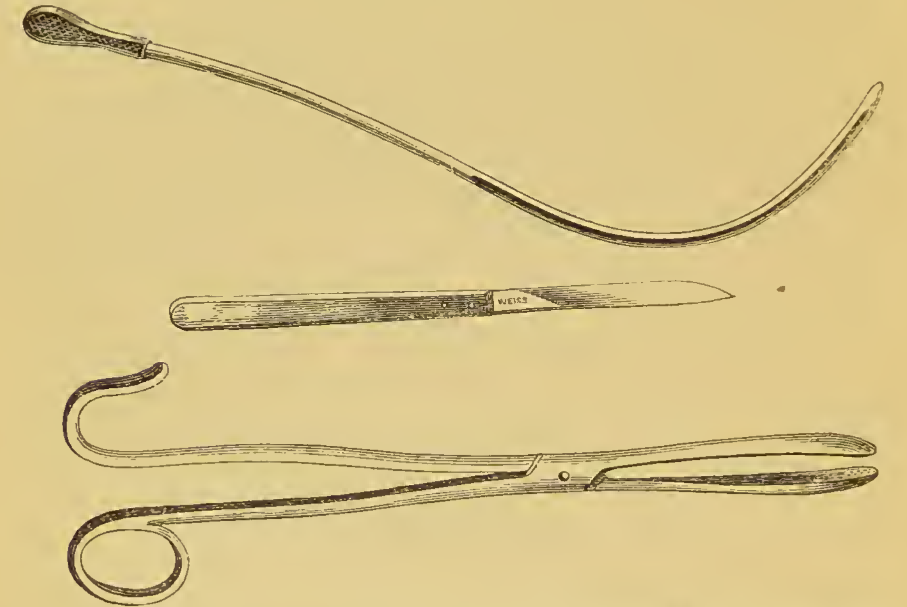
SYMPTOMS OF CALCULUS IN THE BLADDER.

The leading symptoms produced by a calculus in the bladder are, a frequent, sudden, and urgent desire to pass water,—the desire being often irresistible, especially under exercise, or on change of position; and pain referred to the point of the penis, most severe just as the bladder is emptied, and after making water, when the contraction of the middle coat brings the mucous coat into distinct contact with the calculus. The pain is sometimes of a burning character; at other times, it is a severe, but dull pain, with a sensation as of something lodged at the part, and giving rise to a desire to pull and pinch the prepuce, causing it to become elongated. The skin of the fore-finger and thumb, especially in children, in whom the inclination to pull the prepuce is often observed, becomes, in consequence of being kept wet by the urine, sodden and white like that of a washerwoman's hands. Sometimes the flow of the urine is suddenly stopped by the stone covering the inner orifice of the urethra, and is restored on a change of posture removing the stone from that position. As the stone increases in size, the symptoms become more and more urgent; the pain at the point of the penis is frequently accompanied by sympathetic pain about the rectum similar to tenesmus; and in most instances, after the disease has been of long standing, the urine ceases to be so clear and transparent as natural, and deposits on cooling, especially after exercise, a quantity of mucus. Such are the leading symptoms caused by a stone of moderate size; but, in the course of time, these symptoms become painfully aggravated, other local symptoms supervene, and the general health, at first little affected, becomes impaired, so that the patient's situation is rendered peculiarly distressing. The urine, instead of preserving its natural clear and transparent appearance, becomes at first merely opalescent from the mucus thrown off by the lining membrane; which mucus is seen, as the urine cools, to subside to the bottom of the recipient vessel, and in some cases, is at times tinged with blood. As the disease advances, the congestion of the lining membrane goes on to inflammation, in which state its sensibility is greatly increased, the desire to make water is almost constant, the pain most excruciating, the urine offensive, and loaded with mucus tinged with blood, its smell fœtid and ammoniacal, and by and by, it contains purulent matter along with the mucus. Inflammation of the mucous membrane aggravates all the symptoms to a very great degree; the pain at the point of the penis is excruciating and attended with the inclination to squeeze the glans penis,—the agony being no doubt caused by the inflamed bladder spasmodically grasping the stone. The sympathetic pains are often very distressing, and are felt shooting down the thighs, and in the soles of the feet. The rectum is not only affected by such pains, but it also becomes irritable, and often liable to prolapsus ani, or to hemòrrhoids. The above are the leading and, as they are called, the rational symptoms of stone in the bladder; but as some of them are somewhat similar to the symptoms of other affections, such as disease of the bladder, disease of the prostate gland, organic disease of the kidney, renal calculus, and, to some extent, organic disease of the rectum, the surgeon should, before giving a positive opinion, make use of the sound, and when, by means of this instrument, he feels the calculus, he is as fully convinced of its existence as if he actually saw it. The symptoms discovered by the sound are called the physical, to distinguish them from the rational, which have already been enumerated.

Treatment.—Of the various modes of treatment recommended for the removal of calculus, we shall refer to three, Lithotomy, Lithotrity, and Lithotripsy.

LITHOTOMY, OR CUTTING FOR THE STONE.

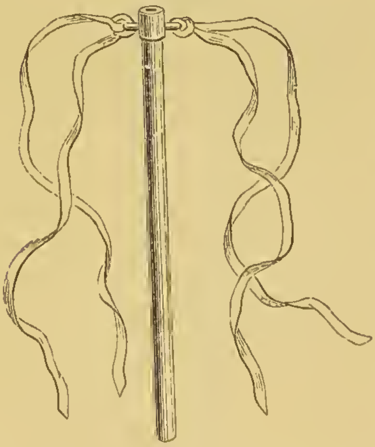
Cutting for the stone has been tried by a number of different proceedings, which, however, may be classed under three principal methods,—perineal lithotomy, recto-vesical lithotomy, and hypogastric lithotomy, of which the two last are now obsolete. Of perineal lithotomy there are different methods, some of which are median, lateral, bilateral, and quadrilateral, and there are "an infinity of minute variations in the mode of performance" of some of them. The modification of the lateral operation introduced, and so successfully and skilfully practised by the late lamented Mr. Liston, who, while he lived, was deservedly regarded as the first lithotomist, is, in the opinion of the author, the simplest, the best, and the most elegant of all methods, and should in almost every instance in which lithotomy is justifiable, be preferred. By Liston's modification of the lateral operation, and in cases of large stones, by free lateral incision of the perineum with bilateral section of the prostate gland, all that can reasonably be looked for from lithotomy will be more easily and safely accomplished than by any other methods with which we are acquainted. Mr. Liston's mode of lithotomy has been adopted by the great majority of operating surgeons, and may be thus performed :—



Figs. 211—213.

The perineum having been shaved, the rectum having been cleared by a dose of castor oil on the evening before, and an injection on the morning of the operation,—the patient, having retained his urine from half-an-hour to three-quarters of an hour previous to the operation, should be brought under the influence of chloroform, and then a staff of the largest size the urethra will admit, having a deep groove between its convexity and left side, should be introduced, and the stone having been felt, the charge of the staff should be given to the principal assistant. The hands and feet of the patient should be tied to each other, and his body placed in the attitude shown by the accompanying drawing. If the staff be of the largest size that can be conveniently introduced, it will be easily felt after the first incision, and the urethra can without difficulty be opened upon it. The staff should be drawn up under the pubes to keep the prostate gland from being imbedded in the rectum, and held steadily by the assistant in that position throughout the different stages of the operation. The

Fig. 214.



operator should then introduce the forefinger of the left hand into the rectum to make sure of its being empty, and to excite it to contract, which will diminish the risk of its being injured during the operation. I have always followed the example of Mr. Liston in making the introduction of the finger into the rectum the last thing before the commencement of the operation, in order to diminish the danger of its being wounded, and the first thing after its completion,

Fig. 215.

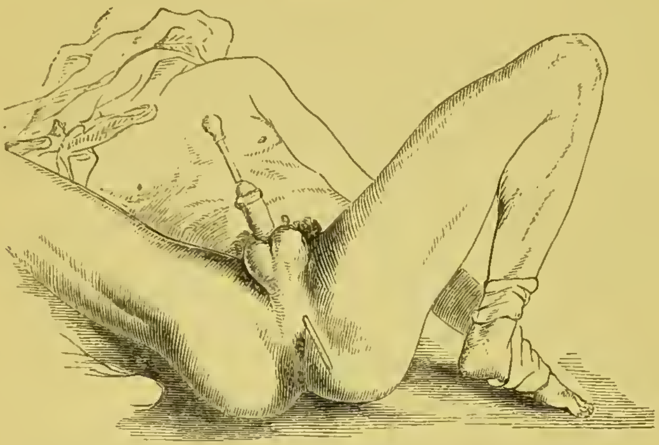
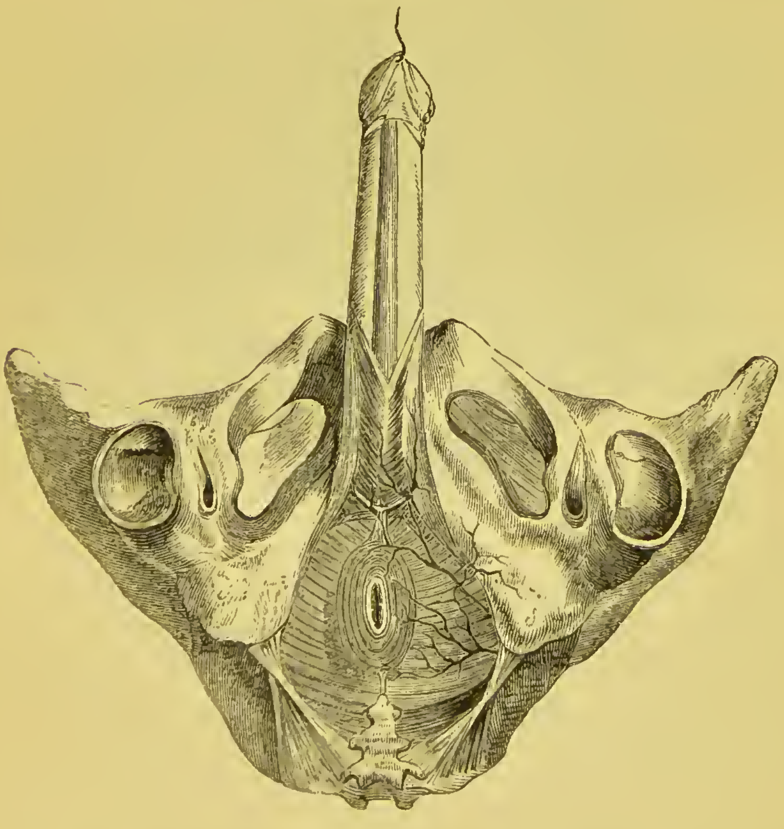
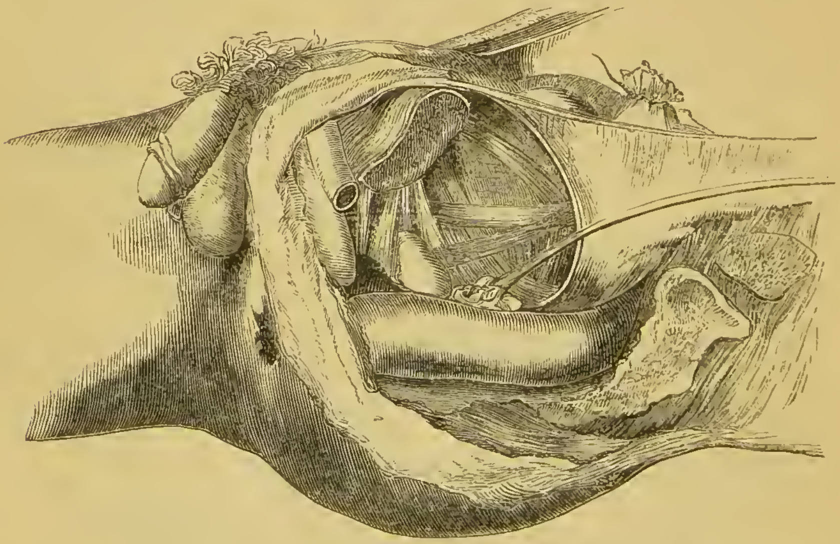


Fig. 216.



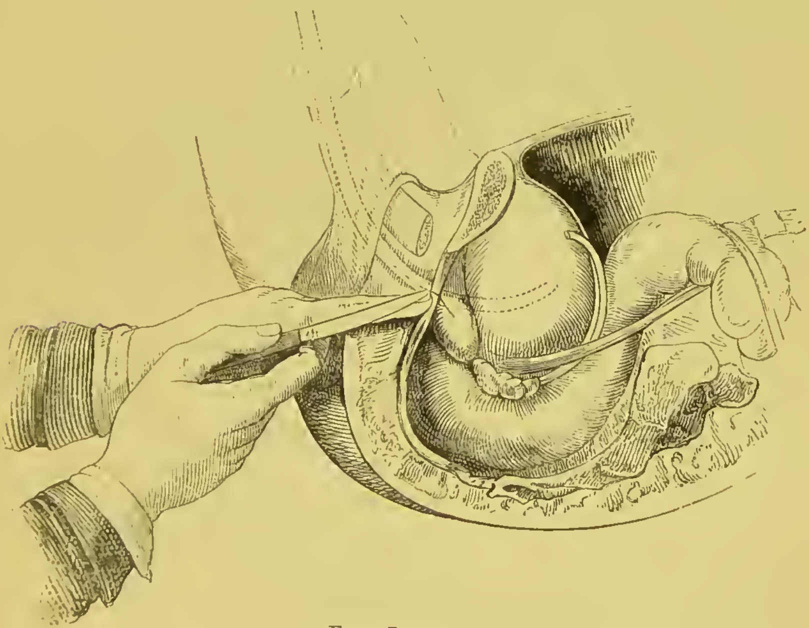
to make sure of its being safe. The first incision is then made by introducing the knife pretty deeply into the perineum at the left side of the raphè, and about an inch in front of the verge of the anus, and by carrying it downwards and outwards to rather more than an inch below the anus, and so directing it that the middle of the incision may be about midway between the anus and the tuberosity of the ischium. By this means the skin and superficial fascia are divided. The forefinger of the left hand is then pressed into the middle of the wound for the purposes of putting aside cellular tissue and thereby enlarging the wound, of keeping the rectum out of harm's way, and of feeling for the staff in the membranous portion of the urethra. Such fibres of the transversus perinei and levator ani muscles as oppose the onward progress of the finger should be carefully divided by the knife. The groove of the staff is easily felt anterior to the deep fascia of the perineum. The point of the nail of the forefinger should be pressed against the groove, and the knife, carried along the back of the finger, should be made to enter the groove, about three lines in front of the prostate; and it having been surely ascertained that the knife is in the groove of the staff, it should be cautiously pressed backwards, so as to divide that portion of the membranous part of the urethra which is posterior to where the knife enters the groove, the deep fascia and fibres contained within it, the prostatic portion of the urethra, the left lobe of the prostate gland, and the dense unyielding fibrous band at the base of the prostate, into which the muscular fibres are inserted.

Fig. 217.



The incision should commence about three lines in front of the gland, and should not extend beyond its circumference, so that there may be no risk of the ilio-vesical fascia being divided, as such division would admit of infiltration by breaking up the barrier which this fascia constitutes between the external and internal cellular tissues. The edge of the knife should be directed downwards and outwards. If it be held too horizontally, the section of the prostate, so made as not to extend beyond its base, would be too limited, and the planes of the external and internal incisions would not correspond; if too vertically, the section obtained would also be too limited, and the rectum would be endangered. The finger should be so placed as to protect the rectum, and should follow the knife, which is withdrawn as soon as the incision has been made, and immediately afterwards the principal assistant withdraws the staff; the surgeon retaining his finger in the section of the prostate, prevents the escape of the urine. In most instances the stone can be felt with the front of the finger; the forceps should then be introduced, the finger being used as a guide. The finger is withdrawn as the instrument enters, and

Fig. 218.



From Liston.

at this moment the blades of the forceps should be opened; and in the majority of cases the gush of urine places the calculus between the jaws of the instrument. If the stone is not secured in this manner, the forceps should be closed until it reaches the stone, when its blades should be opened, the stone seized, and efforts made to extract it, the handles of the forceps being depressed so that the line of extraction may be in the direction of the axis of the pelvis, and the forefinger of the left hand preventing the descent of the bladder with the stone and forceps. It facilitates the remaining steps of the operation if the external incision be made free; but the internal incision should be limited;—the great object being to avoid cutting beyond the circumference of the prostate, so that the ilio-vesical fascia, which is the barrier between the external and internal cellular tissues, may be entire. The prostate, the mucous coat and muscular fibres at the neck of the bladder, are so yielding that the wound can be easily dilated without any laceration, and thus a stone of very considerable size can be readily extracted through an incision of very limited extent, perhaps not more than seven or eight lines in length, and not extending into the bladder beyond the base of the prostate. If the stone be too large to be safely extracted through the limited opening now described, the most judicious course then is to introduce a probe-pointed bistoury along the finger, and effect a similar incision on the right side of the prostate; in short, to make what is called the bilateral section of the gland—a proceeding which may be adopted from the first, if it is certain that the stone is too large to be extracted through a section on one side of the prostate gland.

It having been ascertained by the appearance of the stone, or, if necessary, by the use of the searcher, that there is not another calculus, the elastic tube is introduced into the wound to facilitate the escape of the urine, and thereby to diminish the danger of infiltration; and for the promotion of the same object, the patient after being removed to bed, is placed on his back with his shoulders a little raised. Such is the simple and safe mode of performing lithotomy with the knife, recommended by Mr. Liston, and which I often witnessed with the greatest admiration when I was his pupil.

The structures divided in this operation are the integument, two sets of fasciæ, namely, the superficial fascia, and the two layers of the deep fascia; the transverse muscle of the perineum on the left side, some of the fibres of the levator ani, and the muscular fibres between the two layers of the deep fascia; the external hemorrhoidal arteries, and the transverse artery, with their associate veins and nerves; the cellular and adipose tissue in the ischio-rectal excavation; a few lines of the back part of the membranous portion of the urethra, the prostatic portion of the urethra, the left lobe of the prostate gland, and the dense, unyielding, fibrous band at the base of the prostate, into which the muscular fibres are inserted. If the incisions are properly arranged, the above are the only structures that will be interfered with. The principal dangers to be guarded against are, bruising the soft parts, wounding the rectum, wounding some important artery, as the artery of the bulb, and too extensive division in making the section of the prostate. The precautions to be adopted for avoiding the first and second of these dangers have been mentioned; the third is avoided by not commencing the incision too high up; and the fourth by limiting the extent of the incision so as not to cut the bladder beyond the circumference of the prostate. Some arteries occasionally deviate from their usual arrangement, and are then in danger of being wounded. The artery of the bulb occasionally arises from the pudic near the tuber ischii, and crosses the line of incision. Should it be wounded, it ought if possible to be secured by a ligature. The pudic artery, even when presenting that abnormal arrangement in which it lies on the posterior edge of the prostate, would be wounded only if the incision reached beyond the gland;—an additional reason to that already given for limiting the extent of the section. In old persons there is sometimes venous hemorrhage from the veins around the prostate, which often become enlarged at an advanced period of life. This is most efficiently arrested by pressing some plugs of lint around the tube; and the same plan is adopted in the case of arterial hemorrhage, when it is difficult to find the artery, and the hemorrhage does not cease on the thighs being brought together, which, however, it often does, from the opposite sides of the wound being then more closely pressed against each other. In the event of lint being introduced, it is necessary to be exceedingly careful that the tube be kept completely pervious.

The principal object of the tube being to prevent urinary infiltration, it is retained until it is reasonable to suppose that the cells of the cellular tissue are closed by effusion of lymph. In young persons, twenty-four hours will be sufficient for this purpose, the process of effusion being rapid at that period of life; but in persons of a more advanced age, or of a relaxed habit of body, it should be retained for at least forty-eight or fifty hours; and the greatest care taken for the first few hours after the operation until the urine become colourless, to observe that occlusion of the tube be not produced by coagulated blood. The important objects of attention for the first few hours are, that there be no hemorrhage, that the tube be pervious, and that the urine flow plentifully, and gradually become colourless. The secretion having become colourless, and no particular constitutional sympathy having manifested itself, the early and principal dangers are passed. On the withdrawal of the tube, the wound may be dressed with a little lint, and subsequently with a little lint dipped in oil, resinous ointment or turpentine liniment, according to the particular state of the granulations. In many instances no application whatever is required. The greatest care should be taken to keep the nates free from inflammation and excoriation by the use of the spirit lotion, lard, and the frequent change of sheets, so as to keep the parts as dry as possible; the mind should be encouraged, the strength kept up by all means which in the particular circumstances of the case would be judicious, the frequent error of keeping the patient too low avoided, and the constitutional treatment in other respects conducted according to the common principles of surgery. In the course of eight or ten days a little urine comes by the urethra, generally causing a slight pain and irritation the first time, and the patient seldom feels so well for that day; the quantity gradually increases, and in three or four weeks, sometimes more and sometimes less, the whole comes by the urethra, and the continuity of the parts is restored by the healing of the wound, after which the treatment proper for the diathesis should be continued, as reproduction of stone occasionally, though very rarely, occurs.

RESULTS AND CAUSES OF DEATH.

From a limited number of cases, no correct estimate can be formed of the general mortality from lithotomy. Great success may attend the operation in a limited number of cases, but different results are obtained when the number is greatly increased. Surgeons of extensive experience are well aware of this fact. "Ten, twenty, thirty cases may succeed without interruption, and the operator flatters himself he is never to lose a patient, when two or three deaths follow in quick succession, and reduce him to a level with his neighbours; or at least within the limits of variation which the analysis of a large number of cases indicates." The following results strikingly illustrate this point:—At the period I ceased to be a pupil of Mr. Liston's he had operated on 32 patients in succession, and lost only 1; but his next patient died, and increased his deaths from 1 in 32 to 2 in 33. Mr. Liston, in 6 years, operatedon 24 patients in University College Hospital, and all recovered. During the whole period of his connexion with this hospital he operated on 37 patients in all, of whom 5 died, increasing his mortality to 1 in 7·2. In Norwich Hospital, 38 patients were successively operated upon by Dalrymple, Norgate, and Crosse, and all recovered; but the average mortality in that hospital, taken from 704 cases, has been 1 in 7¾. Mr. Coulson, in his admirable work on Lithotrity and Lithotomy, gives a table of 6369 operations; the number of deaths was 958; and the general mortality, therefore, is 1 in 6·62 cases. The average mortality in England, deduced from 1743 cases of the lateral operation, is 1 in 6·93; in France it is 1 in 5·7; and for Europe generally, 1 in 5·14.

Age exerts a remarkable influence on the mortality after lithotomy, as the following table from Coulson demonstrates:—In 2972 cases, the mortality increased at each successive decimal period. Thus, below 10 years it is 1 in 13, and thence gradually augments, from 10 to 80 years, to 1 in 9, 1 in 6, 1 in 5, 1 in 4, 1 in 3·65, 1 in 3·23, 1 in 2·71.

Causes of Death.—The principal causes of death are, 1st, shock; 2nd, hemorrhage; 3rd, diffuse inflammation of the cellular tissue around the neck of the bladder, between it and the rectum, and underneath the peritoneum; 4th, simple peritonitis and pyæmia. Shock is very rarely a cause of death since the introduction of chloroform. Fatal hemorrhage is a very unusual occurrence; I have never met with it in my own experience in hospital or in private practice, and I have never seen it in the practice of any of my colleagues, notwithstanding the great number of cases cut for stone in this place.

Mr. Liston states that he had only one case of severe bleeding in 100 operations. It is singular to observe how much more prevalent this accident is on the Continent. Boyer states that hemorrhage is one of the chief dangers of lithotomy; and Bègin, after great pains to ascertain the proportion of fatal cases produced by hemorrhage, sets it down that one death out of every four deaths after lithotomy is occasioned by hemorrhage. The difference may be owing to the use of the lithotome caché. It is well known that hemorrhage was more common in England when the cutting gorget was used than it has been since the introduction of the knife. The sources of hemorrhage and the treatment have already been mentioned. Of all causes of death, diffuse inflammation of the cellular tissue around the neck of the bladder is by far the most frequent. This may be caused in one of two ways: by infiltration of urine, owing to the mucus being carried beyond the prostate, or to bruising in the extraction of a large calculus. Rigors, dry heat of skin, quick pulse, dry brown tongue, some pain and tenderness at the lower part of the abdomen, especially on the left side, and afterwards tympanitic distension of abdomen, hiccup, weak and often intermittent pulse, are the principal symptoms of diffuse cellulitis when caused by infiltration of urine, and they are the same in character, and nearly as fatal, when produced by bruising. The treatment is conducted on the general principles, as in the treatment of diffuse cellulitis in other parts. Ammonia, wine, brandy, and nourishment, are the chief means, and in some instances free incision into the sloughing and infiltrated tissue may be the means of saving a patient, as occurred in one case in the practice of Brodie.

The influence of the size of the stone on the mortality after lithotomy will now be clearly understood, and the explanation will be evident of the well-known fact, that the mortality increases in the direct ratio of the size of the calculus. It has been well observed, "that the surgeon is often placed between the horns of a dilemma. He must either cut beyond the limits of the prostate, and thus incur the risk of inducing urinary infiltration of, or diffuse inflammation in, the cellular tissue, or else by limiting his incision to the margin of the gland, and thus, having perhaps an aperture of insufficient size, inflict severe injury by the bruising and laceration of parts during forcible and possibly prolonged efforts at extraction." Mr. Crosse of Norwich has drawn up a table of 703 cases, which shows very clearly how the danger of the operation increases with the size of the stone. He found that when the weight of the stone was under 1 ounce, the deaths were in the proportion of 1 in 11·25 cases; when from 1 to 2 ounces, there was 1 death in 6·61 cases; when from 2 to 3 ounces, 1 death in 2·18; when from 3 to 4 ounces, 1 death in 1·57; when from 4 to 5 ounces, 1 death in 1·66 cases.

When peritonitis or pyæmia occur, they must be treated in accordance with the principles proper for these states.

HISTORICAL SKETCH OF PERINEAL LITHOTOMY, AND THE VARIOUS MODES OF OPERATING.

THE METHOD OF CELSUS.

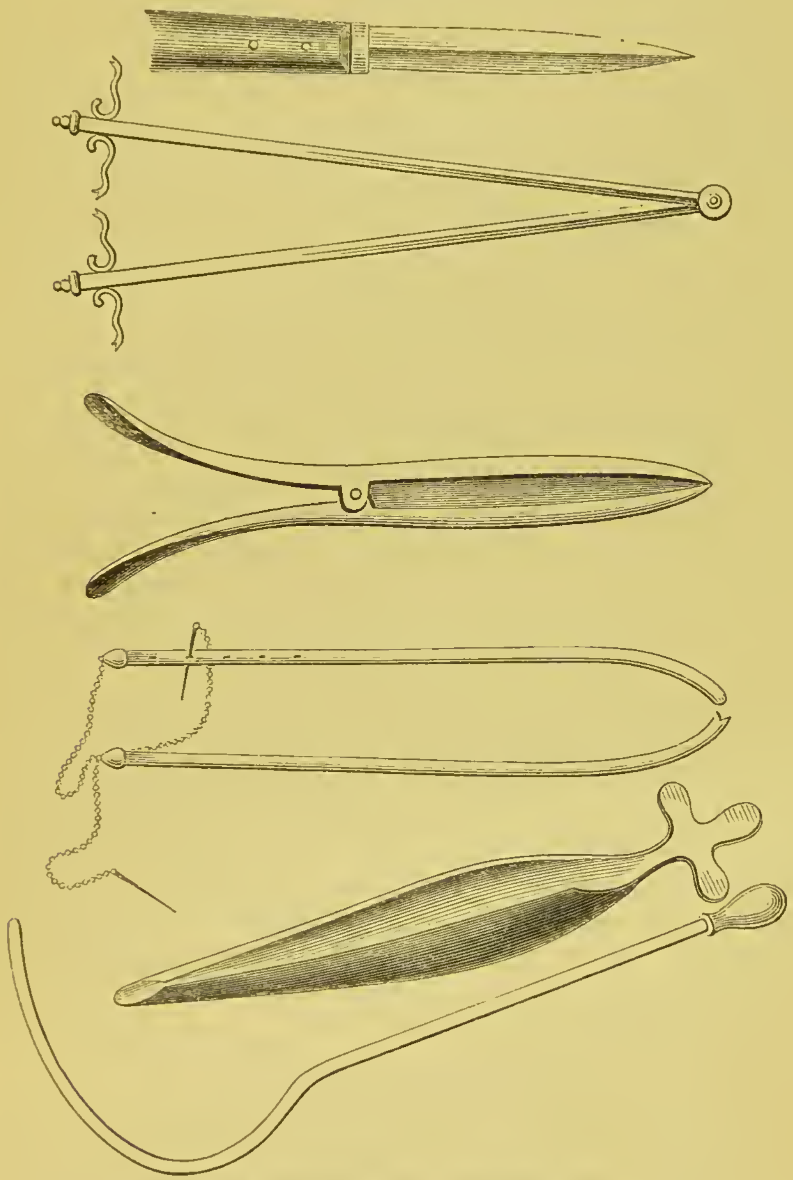
This mode of operating, the most ancient on record, and the only one in use down to the sixteenth century, deriving its name of Lithotomia Celsiana from having been described by Celsus, has also been called cutting on the gripe, and, the operation by the apparatus minor, on account of the fewness of the instruments required,—a knife and a hook, and sometimes only a knife, having been used.

The rectum having been emptied by means of a clyster, and the patient having walked about the room to bring the stone down to the neck of the bladder, he was placed in the lap of an assistant, whose duty it was to hold him, and to keep the thighs bent and separated so as to expose the perineum. Sometimes, if the patient was not a young person, two assistants were strapped together by the thighs to support him between them, each having charge of a thigh. The operator, having oiled his fingers, introduced the index and middle fingers of the left hand into the rectum, and endeavoured to get them behind the stone, to force it forwards to the neck of the bladder, and to make it cause a prominence in the perineum. A lunated incision was then made, having its convexity forwards to the bulb of the urethra and its concavity backwards to the anus, the extremities being directed to the ischia. The words of Celsus, "cornibus ad ischia spectantibus," show that those writers are mistaken who say that the extremities of the incision were directed to the left hip. The parts between the middle of this incision and the stone were cut through, and the operator then endeavoured to press the stone through the wound, or to extract it by means of a hook.

THE OPERATION BY THE APPARATUS MAJOR.

The next operation we read of in the history of perineal lithotomy is known by the names of the operation of Johannes Romanus, by whom it was devised,—the Marian operation, or the Sectio Mariana, in consequence of a minute description of it having been given by Marianus Sanctus, a pupil of Johannes Romanus,—the operation by the apparatus major, from the multiplicity of instruments employed (l'opération par le grand appareil, Fr.), and median lithotomy, from the first incision having been made in the mesial line in the perineum. The reason assigned for the introduction of this mode, and the abandonment of that previously in use, was the declaration of Hippocrates that "wounds of membranous parts are mortal." It was supposed, however, that such parts might be dilated with safety, and it was on the principle of dilatation that the operation was founded. The patient having been placed on a table with his shoulders raised, his hands were bound to his feet, and the latter were separated from each other, drawn upwards, and still more firmly fixed by turns of a bandage passed round his neck and shoulders; and in this attitude he was held by assistants. A grooved staff was then introduced into the bladder, and an incision made with a razor in the middle line of the perineum extending from behind the scrotum to near the verge of the anus; by the further application of the knife the bulbous portion of the urethra was opened; and this was all the cutting employed in the operation. The operator having the point of the knife lodged in the groove of the staff, introduced a probe into the bladder, guiding it by the knife into the groove, and by the staff into the bladder. The knife and staff having been withdrawn, the instruments for dilatation

Figs. 219—224.



Instruments constituting the "Apparatus Major."

were then used. These were two, called the male and female conductors. The female conductor, which was a long director with a groove, was introduced along the probe, when the latter was withdrawn, and the point of the male conductor having been placed in the groove of the female, was pressed onward into the bladder. The lithotomist then, by taking the extremity of a conductor in each hand, and separating them from each other, commenced the work of dilating, or rather tearing up the membranous and prostatic portions of the urethra and the neck of the bladder. After all the dilatation that could be effected by the conductors had been accomplished, the grand forceps was introduced between them into the bladder, and employed first in still increasing the dilatation, and then in seizing and extracting the stone. After Marianus, who gave the first description of the operation, his successors contrived many other instruments to be used after the male and female conductors, in tearing open the neck of the bladder. The principal of these were the gorget of those days, which was in use in the time of Collot, though its employment was not patronized by him; the simple dilator, which dilated by its handles being brought together; the dilator of some authors, an entirely different instrument; and the double dilator. By some or other, or all of the above-mentioned instruments, together with the fingers of the operator, the membranous and prostatic portions of the urethra, prostate gland, and neck of the bladder, were torn open to make room for the extraction of the stone. The cruelties of this operation could scarcely have been exceeded; but although its results were such as might have been expected, it was still practised from 1520, when it was first proposed, to 1697, when Frère Jacques de Beaulieu taught the surgeons of Paris to despise it, and proposed another mode of operation.

Some of the most celebrated operators with the grand appareil, were Marianus, Paræus, the family of the Collots, who were Lithotomists to the kings of France for several generations (the elder Collot having been appointed Royal Lithotomist to Henry II., and having been the first person on whom that title was conferred), Octavius de Ville, Toletus, and Mery and Marechal, the surgeons-in-chief to the Hôtel-Dieu and La Charité Hospitals in Paris.

OPERATION OF FRÈRE JACQUES.

Frère Jacques, a native of Langsauniere, in Burgundy, devised a method of cutting for the stone, which shall presently be described. Having practised this method with success in various towns on the Continent, he went to Paris, where he had influence enough to obtain from President Harley an order to perform his operation on a dead body in the Hôtel-Dieu, in the presence of the surgeons of Paris. Mery, surgeon-in-chief of the hospital, was required to report regarding it.

On the 7th of December, 1697, Mery received the first order to witness Frère Jacques cut a dead body for the stone in the Hôtel-Dieu, and on this experiment he gave a most favourable report. On the 14th of the same month he received a second order from the President to witness Frère Jacques make further trials of his operation on dead bodies in the Hôtel-Dieu; and it is remarkable that Mery, who indeed is supposed to have been influenced by the violent jealousies entertained towards Frère Jacques by the lithotomists and surgeons of the day, and to have become the organ of their party, reported in opposite terms of those further experiments, and condemned what previously he had strongly praised. In consequence of this, Frère Jacques lost the support of President Harley, and being dispirited, left Paris without being allowed to perform his operation on the living body. He then went to Fontainebleau, where he was introduced to Daschene, one of the physicians to the court; to Bourdelot, physician to the Duchess of Burgundy; to Fagon, physician, and to Felix, surgeon, to Louis XIV.; and by the influence of these gentlemen an order was given by the court, that he should perform his operation on a boy from Versailles, then living at Fontainebleau, who was afflicted with stone. He performed the operation in the presence of the above-named gentlemen, and in a manner to command their admiration, and in three weeks the boy was seen running in the streets perfectly well. The consequences were, that Frère Jacques cut six other persons at Fontainebleau, gained the favour of the court, and the enthusiasm of the people, and returning to Paris, and there operating in private on twelve persons, produced such an impression on the public mind, that President Harley summoned a meeting of the physicians, surgeons, and managers of the Hôtel-Dieu, together with the magistrates of Paris, and others, at the palace of the archbishop, on the 7th of April, 1698, requiring another report on this operation. The contest at this meeting is said to have been very violent. The operators by the apparatus major, finding that all they had been proud of in their method was in danger, with themselves, of falling into neglect, were as strong in their opposition to the new mode as the friends of Frère Jacques were in their approval of it; but the final result of the discussion was, that the latter were triumphant, and it was resolved that, in the ensuing season of cutting for the stone, Frère Jacques should be allowed to perform his operation in the Hôtel-Dieu and at La Charité. He operated accordingly, but unfortunately for him, of sixty-two patients whom he cut in those hospitals, twenty-five died, seven having been carried dead out of La Charité in one day. This occasioned the renewal of the persecution which had before been directed against him, and it was now carried on not only by the lithotomists and surgeons, but also by the priests, whose violent hatred he had incurred on account of his accusing them of having poisoned his patients and injured their wounds for the purpose of bringing discredit on his operation. A second time, therefore, he left Paris, but continued to practise his operation in the chief towns of France, and in Holland and Germany, to the great admiration of those who witnessed his proceedings. Up to this period of his career, Frère Jacques was perfectly ignorant of anatomy; he was not aware of the danger of wounding parts, the structure of which was unknown to him; and hence he had all the boldness of a man unconscious of danger. In the operation hitherto practised by him, called, in the history of his proceedings, his original uncorrected operation, he introduced into the bladder a large peculiarly-shaped staff, without a groove, and holding it with his left hand, he with the right plunged a long dagger-shaped knife along the side of the tuber ischii of the left side into the bladder; having made a sufficiently large opening, he next introduced into the bladder a conductor through the wound, and having carried a forceps along the conductor into the bladder, he then withdrew the conductor and staff, and endeavoured to extract the stone. The staff, as we have already stated, had no groove, nor was it used to guide the knife into the bladder.

Fagon, the king's physician, was deeply impressed with the boldness with which Frère Jacques performed his operation, and being himself afflicted with stone, he formed the resolution of allowing Frère Jacques to operate on himself; and partly perhaps with that view, and partly from admiration of his boldness and benevolence, he invited him to return to Versailles, and kindly inducing him to live in his house, persuaded him to study anatomy, and to make dissections under the direction of the celebrated Du Verney. Frère Jacques operated on the dead body, and the parts were then dissected by Du Verney, who, together with Fagon and Felix, the king's physician and surgeon, pointed out to him the dangers against which he had to guard; and the result was, that they induced him to perform what is called his second, or improved operation, which differed from the former in the use of a grooved staff for conducting the knife into the bladder. This operation he practised on the dead body, in the presence of his three friends, until Du Verney pronounced his experiments on the dead body perfect; and his success on the living body was such that he at one time cut thirty-eight persons without losing a single patient. Such is the history of Frère Jacques's improved method, which has always been considered as the foundation of the very superior mode of perineal lithotomy practised in the present day.

A celebrated writer gives the following account of an event which occurred about this part of Frère Jacques's career, and exercised great influence on public opinion with reference to his operation:—

"There were at this moment two men of eminent rank who had resolved to submit to the operation of Frère Jacques; the one, Mr. Fagon, first physician to Louis XIV., the other the Maréchal de Lorges; both had taken measures to ensure the success of the operation; but in the very moment that Frère Jacques was about to obtain the most distinguished honour, he suffered a sad reverse of fortune. Mr. Fagon had himself taught Frère Jacques, and with the assistance of Du Verney, the celebrated anatomist, and Felix, first surgeon to the king, had made him go through a series of dissections. His operation was reformed according to their desire; he had forsaken his big round staff, and cut upon a grooved one; he had operated on thirty patients in the Hôtel-Dieu of Versailles with uninterrupted success; he had already sounded Fagon, and felt the stone; yet Fagon, though thus far advanced in this generous design, was prevailed on, by the solicitations of his friends, to put himself into the hands of Maréchal, who had learned to perform Frère Jacques's operation. Maréchal accordingly performed the operation, and Fagon survived, and in a few weeks went abroad in his carriage. The Maréchal de Lorges, of distinguished rank and great fortune, proceeded with equal precaution; he assembled in his hotel twenty-two poor people afflicted with the stone, who were cut by Frère Jacques with perfect success; but while the poor patients survived, the Maréchal himself died in tortures the day following the operation. This was decisive of the fate of our operator. The Maréchal de Lorges lying dead in his superb hotel, while Fagon, cut by Maréchal, was rolling in his chariot in the streets of Paris, was a triumph for the regular lithotomists, and a mortal blow to the reputation of Frère Jacques, who now departed from Paris never to return."

Frère Jacques operated on nearly five thousand patients in all; he was benevolent, candid, and disinterested; he never accepted more money for his services than was necessary to mend his shoes and to sharpen his instruments. He operated with astonishing success in different parts of France; also at Amsterdam, where he was presented with a gold medal for his public services; at the Hague, where he received a present of gold sounds, which it is said he afterwards had melted to give to the poor; and at Delft, Leyden, Padua, and many other places; after which he went to Rome to receive the benediction of the Pope; and then returning to his native village, at an advanced period of life, he distributed among the poor what little money he possessed, and died, according to Morand, in June, 1714.

RAU'S OPERATION.

Rau, Professor of Anatomy at Leyden, and teacher of the celebrated Albinus, was the next great lithotomist that appeared. He had seen Frère Jacques operate, and had himself operated with great success; but he refused to tell any one his mode of proceeding, and died without leaving any description of it. From the account which Albinus gives of it, it is believed that its peculiarity consisted in cutting into the bladder behind the prostate, and dividing the prostate by cutting from behind forwards, instead of, as in Frère Jacques's improved operation, from before backwards. In this proceeding, a grooved staff was used.

CHESELDEN'S OPERATION.

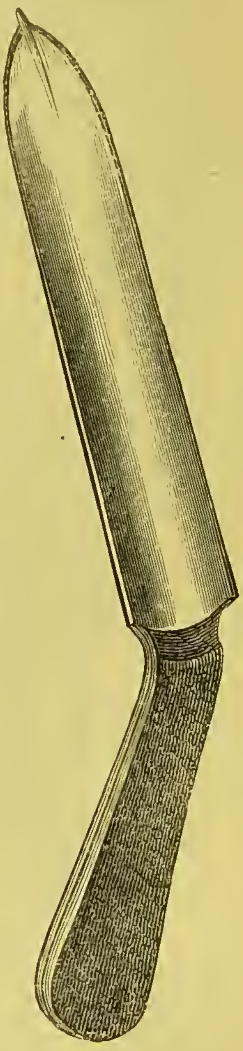
The celebrated Cheselden, surgeon to St. Thomas's Hospital, London, being deeply impressed with the success of the operations of Frère Jacques and Rau, resolved to abandon hypogastric lithotomy, or, as he called it, of cutting into the bladder by the highway, and to perform perineal lithotomy. From Cheselden's own description of his proceedings, contained in the appendix to different editions of his "Anatomy," and from the account of the operation as he at one time practised it, given by Douglas, who states that he received it from Cheselden himself,—it is perfectly clear that when he first practised perineal lithotomy, after making his incision in the perineum, he endeavoured to cut into the under part of the lateral region of the bladder, and then fixing his knife in the staff, he divided the prostate gland and neck of the bladder from behind forwards. This method, however, he afterwards abandoned, as being not only difficult of performance, but also unsuccessful, chiefly from sloughing and infiltration of the cellular tissue.

Cheselden's second operation has been uniformly regarded as superior to any adopted before his time; and, indeed, with slight modifications, it is nearly the same as that practised by most of the best lithotomists at the present day. On this subject, the lamented Mr. Liston wrote, as his deliberate opinion,—and, in former days, when I had the great privilege of being his pupil, I repeatedly heard him make the same statement,—"Depend upon it that, somewhat modified, it is the best operation that can be performed; it is one I have practised with little alteration for many years, and in not a few cases, and I see no reason to change it for any other." The following is Cheselden's account of his second operation, as I find it given by him at page 330 of the thirteenth edition of his work on Anatomy now before me:—

"I first make as long an incision as I can, beginning near the place where the operation ends, and cutting down between the musculus accelerator urinæ and erector penis, and by the side of the intestinum rectum. I then feel for the staff, holding down the gut all the time, with one or two fingers of my left hand, and cut upon it in that part of the urethra which lies beyond the corpora cavernosa urethræ and in the prostate gland, cutting from below upwards, to avoid wounding the gut; and then passing the gorget very carefully in the groove of the staff into the bladder, bear the point of the gorget hard against the staff, observing all the while that they do not separate and let the gorget slip to the outside of the bladder; then I pass the forceps into the right side of the bladder, the wound being on the left side of the perineum, and as they pass, carefully attend to their entering the bladder, which is known by their overcoming a straightness which there will be in the place of the wound; then, taking care to push them no further, that the bladder may not be hurt, I first feel for the stone with the end of them,—which having felt, I open the forceps, and slide one blade underneath it and the other at top; and if I apprehend the stone is not in the right place of the forceps, I shift it before I offer to extract; and then extract it very deliberately, that it may not slip suddenly out of the forceps, and that the parts of the wound may have time to stretch, taking great care not to gripe it so hard as to break it; and if I find the stone too large, I again cut upon it as it is held in the forceps."

Cheselden's success was very remarkable. On this point he says, "What success I have had in my private practice I have kept no account of, because I had no intention to publish it, that not being sufficiently witnessed. Publicly, in St. Thomas's Hospital, I have cut two hundred and thirteen; of the first fifty only three died; of the second fifty, three; of the third fifty, eight; and of the last sixty-three, six. Several of these patients had the small-pox during their cure, some of whom died, but I think, not more in proportion than usually of that distemper; these are not reckoned among those who died of the operation. The reason why so few died of the first two fifties was, at that time few bad cases offered; in the third, the operation being in high request, even the most aged and most miserable cases expected to be saved by it; and, besides, at that time I made the operation lower, in hopes of improving it, but found I was mistaken."

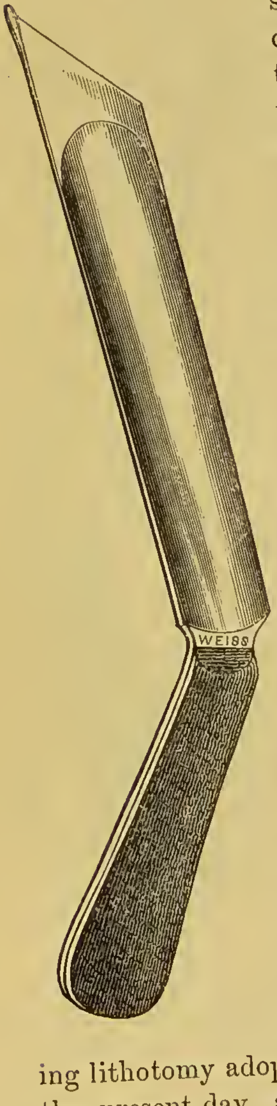
Fig. 225.



SIR CÆSAR HAWKINS'S MODE.

The next important change in the mode of proceeding among the surgeons of this country was that introduced by Sir Cæsar Hawkins, surgeon to St. George's Hospital, who, having an edge put upon the blunt gorget of the apparatus major, thereby converted it into a cutting gorget; and after cutting with the knife into the membranous portion of the urethra, he effected an opening into the bladder by dividing the prostate with the gorget. After this method became known, many different forms of gorgets and gorgerets were invented; which it would answer no useful purpose to describe. Of one of them, Mr. Liston remarks, "It is more like an implement for cutting turf, —a 'flauchter-spade,'—than for performing a delicate surgical operation." Of other instruments invented for dividing the prostate, and cutting into the bladder, some of the most celebrated were the bistouri cachée of Cosme; the gorgeret cistotome-dilatoire-composé of Le Cat; and the double lithotome, used by Dupuytren in his bilateral section.

Fig. 226.



DUPUYTREN'S OPERATION.

Sectio-bilateralis.—The bilateral section of Dupuytren consisted in making a semilunar incision, having its convexity forwards, and extending from between the anus and the tuberosity of the ischium on the one side, to the corresponding part on the other; in continuing the dissection so as to divide all the parts over the membranous portion of the urethra, and opening this membranous portion for a short distance from before backwards; after which, the double lithotome was fixed in the groove of the staff, and by it conducted into the bladder; then, the staff having been withdrawn, the concavity of the lithotome was directed downwards, the blades were expanded, and in withdrawing the instrument, the double section was effected. A double reason in favour of this proceeding is, that there is no risk of wounding the rectum, nor of injuring the pudic arteries, unless the blades be expanded to an unnecessary extent.

It is hoped that, from the preceding account, may be clearly understood the mode of performing lithotomy adopted by some of the most distinguished surgeons of the present day, as well as the principal methods we read of in the history of the operation, and their most important varieties.

Median lithotomy has recently been strongly advocated by Rezzoli of Italy, Manzoni of Verona; and more recently Dr. de Borsa has strongly advocated the operation called lithectasy, which consists of cutting in the mesial line and dilatation. The instruments required are, a staff, a bistoury, and a forceps; and the operation consists in making an incision into the membranous portion of the urethra through the raphé of the perineum, in pressing the left index finger into the bladder along the right side of the staff, in dilating the neck of the bladder by semi-rotatory movements of the finger, to an extent to admit of the introduction of the forceps. Mr. Allarton's operation is a modification of the form of lithectasy now described. In his operation, the forefinger of the left hand is introduced into the rectum, a bistoury is made to enter the raphè of the perineum a little in front of the anus, and sent back into the membranous portion of the urethra, with its back directed downwards, the finger in the rectum serving as a guide to the sending of the knife to the membranous portion of the urethra, and also warning of its proximity to the bowel. To diminish the risk of wounding the rectum, the staff is firmly drawn up underneath the pubic symphysis. The knife is then sent back a little, towards, but not into, the bladder, and in bringing it forward the external wound is enlarged upwards and forwards, so as to make it upwards of an inch in length. A steel ball probe is then passed along the groove of the staff into the bladder, the staff is withdrawn, dilatation effected by means of the finger, and the stone removed by the forceps. The lithectasy of Willis differs from these proceedings, inasmuch as the dilatation is effected by fluid pressure. Professor Buchannan of Glasgow uses a rectangular staff, with the short branch grooved in its side. Hutchinson has modified this instrument into a catheter staff; and Corrbett has added an external staff, to be fitted into the short branch of the rectangular staff, and by that means to have a direct guide from the skin to the bladder. The late Mr. Avery constructed a most ingenious instrument, by means of which, it has been said, "a baby might perform lithotomy." Mr. Weiss showed me Mr. Avery's instrument some time ago; but as I have always practised Mr. Liston's operation, and could not desire a better mode of lithotomy, I cannot, from personal experience, say anything regarding these numerous varieties of proceeding.

Besides the median, lateral, and bilateral modes of perineal lithotomy, quadrilateral lithotomy has been proposed, in certain circumstances, by M. Vidal de Cassis; but it is unnecessary to describe this proceeding.

HYPOGASTRIC LITHOTOMY.

This operation consists in making an incision into the bladder through the linea alba, immediately above the pubes, the great object being to reach the bladder where it is uncovered by peritoneum. Various plans have been adopted for facilitating this object; one of which is pressing the upper part of the bladder upwards and forwards by means of a catheter introduced through the urethra. One of the immediate dangers is wounding the peritoneum, and one of the great objections to the operation is the danger of infiltration of urine into the cellular tissue around the anus. Many plans have been resorted to for diminishing this danger; one of which is to keep a flexible catheter in the urethra until consolidation has taken place around the wound.

STONE IN WOMEN.

Women are much less liable to urinary calculi than men; but occasionally, on reaching the bladder, a calculus is too large to be carried away by the urethra. Crushing the stone, dilatation of the urethra, cutting and incision with dilatation, are the principal modes of treatment. When the stone is small and soft, lithotripsy is perfectly satisfactory. Dilatation may be accomplished by means of Weiss's female dilater; but the great objection to dilatation is, that it is followed by incontinence of urine. Lithotomy is easy of execution, and not liable to be followed by incontinence. The operation consists in introducing a straight grooved staff into the bladder, in making an incision by means of a straight probe-pointed bistoury, directly upwards towards the pubes, extending through the whole urethra into the neck of the bladder, and removing the calculus by the forceps. Another proceeding consists of incision and dilatation. The proceeding of Fergusson consists in dividing the urethra in the anterior half of its length by means of a probe-pointed bistoury, and in accomplishing dilatation by means of the forefinger oiled.

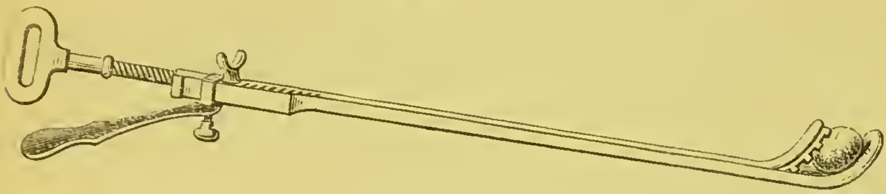
LITHOTRITY.

This term is now used to designate the operation of boring or rubbing a calculus in order to pulverize it, and so remove it through the natural passage. The first person in modern times who adopted proceedings with that view, was General Martin, who, in 1800, operated on himself, and, by means of a file, removed part of a stone with which he was afflicted. In 1813, Gruithuisen proposed the use of a canula, through which a borer was introduced; and after him, several others who had devoted attention to the subject, made various suggestions, possessing more or less ingenuity. But M. Civiale, in 1823, proposed a more ingenious apparatus than any of his predecessors. This consisted of an outward canula containing three branches, which, when thrust out, after its introduction into the bladder, seized and held the stone, on which, when thus firmly fixed, a drill, sent through the inner canula, was made to act. The result, however, of this, and of all other proceedings on the same principle, was far from satisfactory; and, in consequence, the present practice is to crush the stone instead of drilling it,—or, in other words, Lithotrity has been superseded by Lithotripsy.

LITHOTRIPSY.

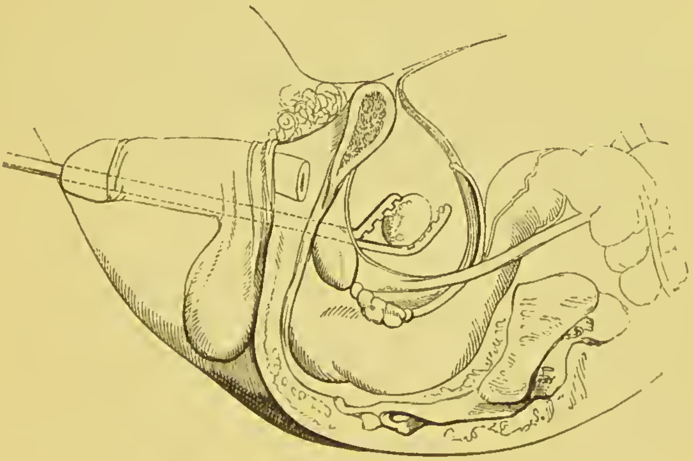
The operation known by this name, for removing calculi by crushing, has now been brought to great perfection. To the late Mr. Weiss, sen., undoubtedly belongs the merit of having invented, and offered to the profession, the first lithotriptor, on the principle of that now in common use; and Mr. Weiss, jun., brought the instrument to its present state of great simplicity and perfection. On the recommendation of Mr. Liston, Mr. Weiss made the handle of metal, instead of wood or ivory, with which it had before been covered,—a change by which the perception of the contact of the instrument with the calculus is rendered much more delicate. At the suggestion, as Mr. Liston informs us, of Mr. Oldham, a gentleman connected with the Bank of England, Mr. Weiss introduced another most important alteration, without which the use of the instrument was more hazardous:—he made the outer blade open, so as to receive the other. The accompanying drawing is a representation of the simple and perfect lithotriptor now in use. Mr. Weiss states that he showed his lithotriptor to many professional men, and among others, to Baron Heurteloup in 1830, who, up to that time, had used the straight drill of Civiale; he immediately adopted the invention, and merely substituting the hammer for the screw, claimed it as his own, calling it his "Percuteur Courbe à Marteau."

Fig. 227.



When the operation is to be performed, the patient is placed on a couch or bed of convenient height, with a pillow below the pelvis, so as to send the stone into the fundus of the bladder. If the bladder should not contain a sufficient quantity of urine to distend it, so that

Fig. 228.



From Liston.

the stone may be crushed without injury to the lining membrane, tepid water should be injected by means of a syringe and catheter, until the bladder contains at least six or seven ounces of fluid. The lithotriptor having been then introduced, and the stone seized, the surgeon, after previously ascertaining that no portion of the lining membrane is entangled, brings the stone to the centre of the viscus, and commences the crushing process by turning the screw ; this should be done very gradually, especially at first. The crushing of the stone is felt by the operator very distinctly. If the stone be very small and friable, it may be pulverized at one seizure ; but more frequently it happens that, after the first crushing, the fragments require to be seized and pulverized.

When one seizure is insufficient, the surgeon must be guided by the susceptibility of the patient in judging how frequently it may be repeated at one time, as, if a very correct judgment be not formed on this point, and if the crushing be carried to too great an extent, very serious consequences are likely to result. When the process has been continued as far as may be necessary, or as the state of the patient may render advisable at one time, a large catheter, with a peculiar opening at its extremity, is introduced, through which the urine and some of the detritus are discharged ; and if considered at the time desirable, a little water may be injected once or twice, by means of a syringe, before the removal of the catheter, in order to favour the escape of detritus, it being important to bring off as much as possible through the instrument, as the transmission by this means occasions no irritation. Rest and antiphlogistic treatment should be strictly enjoined, and the local symptoms which supervene, must be treated according to the common principles of surgery. Fragments pass off for some days, and in their transmission through the urethra often give rise to great pain and irritation. If another operation be necessary, it may be ventured on after the effects of the first have disappeared. The cases favourable for lithotripsy are those of adults in whom the stone is small and comparatively soft, the kidneys, bladder, prostate gland, and urethra organically sound and free from any particular irritability, and the general constitution not more than ordinarily susceptible. There can be no doubt that in such circumstances lithotripsy, in the hands of a judicious surgeon, is a very safe and satisfactory operation ; and that when these favourable conditions combine, it is to be preferred to lithotomy ; but in other circumstances, supposing an operation to be desirable, lithotomy is undoubtedly that which ought to be adopted. If in all cases a correct and unprejudiced judgment be exercised, first as to whether any kind of operation be advisable, and if so, then whether in the particular conditions of each case lithotripsy or lithotomy be the more suitable, operations for the removal of calculi in the bladder will be found sufficiently satisfactory in their results. It is only the abuse of these operations that can bring either the one or the other into discredit.

CHAPTER XX.

AFFECTIONS OF THE TESTICLE AND HYDROCELE.

ORCHITIS.

Inflammation of the testis may be either acute or chronic: it may commence in the body of the testicle, or in the epididymis, forming the epididymitis of some authors; and it may be either primary, as when idiopathic, or when excited by external violence, such as a bruise, a wound, or exposure to cold and wet; or, as is far more frequently the case, consecutive, the inflammation being transmitted from the urethra by spreading along the vas deferens, or perhaps by metastasis,—in which circumstances the epididymis is first attacked and most affected, the tunica vaginalis generally becoming soon involved. An example of orchitis as thus induced has been referred to in the enumeration of the consequences of gonorrhœa, a form of the disease usually acute, and known by the names of "secondary gonorrhœal orchitis," or "hernia humoralis." Secondary orchitis may, however, be the result of inflammation unconnected with gonorrhœa; it may arise from inflammation caused by violence in the introduction of catheters or bougies, or it may be the consequence of strictures, or of the means used to cure them. Sometimes it is an accompaniment or a consequence of mumps, in which case its production depends on metastasis.

ACUTE ORCHITIS.

Symptoms.—When orchitis is primary and acute, the symptoms are, excruciating pain in the testicle, great tenderness, especially as the disease advances,—so that in some cases the patient cannot allow the part to be touched, a distressing sense of weight, a swelling of the testicle, which, however, preserves its oval form, pain extending along the back and in the loins, where it is often extremely severe, and a red, hot, shining appearance of the scrotum. The pain and sense of weight are increased by the erect posture. In very acute cases, nausea, vomiting, and pain in the under part of the abdomen are urgent symptoms, which, in consequence of their similarity, have sometimes been mistaken for symptoms of enteritis. The most severe form of orchitis is usually that which arises from wounds of the testicle. Such injuries are therefore very dangerous, especially in individuals of an irritable habit of body. The constitutional symptoms in the acute primary of the disease are very severe.

Consecutive Orchitis, when originating in the transmission of inflammatory action by continuity of tissue, is usually preceded by slight pain, weariness, and fulness in the groin, where the cord is found to be tender on pressure, and the vas deferens to be enlarged. These symptoms are followed by pain, tumefaction and tenderness of the epididymis, which forms an elongated swelling at the back of the testicle; in many instances this swelling is so great as to render the epididymis as large as the testis, which remains still unaffected. The inflammation soon extends to the tunica vaginalis, when the tumour forms a mass, the different parts of which are no longer distinguishable, and the testis itself becomes involved. The distinguishing peculiarities of this form are the symptoms along the course of the cord in the first instance, followed by the affection of the epididymis, which invariably precedes that of the testis;—the cord, epididymis, tunica vaginalis, and testis becoming successively affected. In this variety the swelling is usually greater, and forms more rapidly; and although there is much variety in the intensity of the symptoms, the pain and constitutional disturbance are for the most part less severe.

In the sympathetic form of gonorrhœal orchitis, namely, that in which the disease presents itself without any previous affection of the vas deferens—a variety sometimes met with, although rare in comparison with the last-mentioned form of the disease—there is an absence of all symptoms indicating any affection of the cord, and the inflammation commences in the epididymis. In by far the greater number of cases of gonorrhœal orchitis the inflammation proceeds along the vas deferens to the epididymis. In seventy-three cases out of one hundred and four noticed by M. Aubry, the inflammation first attacked the vas deferens; in the remaining thirty-one the disease was sympathetic. Gonorrhœal orchitis may occur at any period of an attack of gonorrhœa; but it most frequently commences when the pain and discharge begin to subside. On the connexion supposed to exist between the inflammation of the testis and the state of the discharge, the under-mentioned authorities give the following result of their observations. M. Gaussail states, that in sixty-seven cases out of seventy-three, the gonorrhœa diminished on the first appearance of orchitis; M. Aubry, that in fifty-eight cases out of eighty-one, there was diminution of discharge at the commencement of inflammation of the testicle; and M. D'Espine mentions that in only six cases out of twenty-nine the discharge continued unchanged; while in the remaining twenty-three, it was variously modified, being increased in some, diminished in others, and in others again entirely suppressed. Late observations have shown the incorrectness of the opinion which at one time prevailed, that secondary orchitis is more frequent on the left side than on the right. Of seventy-three cases mentioned by M. Gaussail, forty-five were on the right side, twenty-four on the left, and four were double; of twenty-nine observed by M. D'Espine, twelve were on the right side, eleven on the left, and six double; and of thirty-six which occurred in the practice of Mr. Curling, twenty-one were on the right side, fourteen on the left, and only one double: so that of one hundred and thirty-eight cases, it appears that seventy-eight were of the right testicle, forty-nine of the left, and eleven of both.

Treatment.—The local treatment of acute orchitis consists in the use of leeches, rest, recumbency, support of the testicle, so as entirely to obviate the effects of gravitation, and warm fomentations. Opening a vein in the scrotum is often a convenient mode of local depletion. When the tunica vaginalis is involved, and much pain is experienced from tension, great relief is often experienced from evacuating the accumulated serum. Cold evaporating lotions sometimes give more relief than warm fomentations or poultices; the feelings of the patient are the surest guide whether the warm or the cold are preferable. The constitutional treatment consists in the use of low diet, rest, the free exhibition of antimony, general depletion when the inflammatory symptoms and sympathetic fever are urgent; and after the pulse has been lowered by antimony, and other means, resolution is often promoted, and structure saved, by the use of mercury. Both in the idiopathic form, when the testicle is principally involved, and in the consecutive, when the inflammation has its seat principally in the epididymis and tunica vaginalis, mercury is exceedingly useful: some surgeons confine its use almost entirely to primary, and others to secondary orchitis. I have used it pretty generally in both classes of cases, and am perfectly convinced that much advantage results from doing so. As inflammation originating in the testicle is not only more painful and attended with more constitutional disturbance, but also more apt to endanger the structure and function of the part affected, this form of orchitis requires even more prompt and decided treatment than the others. If suppuration should occur, which, under proper treatment, is more apt to take place in primary than consecutive orchitis, free incision should be made as soon as there is decided evidence that matter has formed; by this proceeding the tubular portion of the organ will be less endangered, and sinuses and fistulous passages probably prevented. When the disease has become chronic, the greatest benefit is often experienced from the cautious employment of pressure, applied by means of adhesive plaster cut into strips, the testicle being separated from its fellow, and the scrotum drawn off as much as possible from the diseased testicle, to admit of the proper application of the strips of plaster. Of the advantages of this treatment in chronic cases I can speak in the strongest terms. Fricke of Hamburg suggested treatment by compression, both in acute and chronic cases, and states as the result of that proceeding, that of fifty-one cases of acute orchitis, eighteen having been treated in the ordinary method, and thirty-three by compression, the

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average duration of the disease in the former was thirteen days, in the latter only nine days. Ricord, Cullerier, Parker, Acton, Curling, Hamilton, and others, have spoken favourably of the results of this practice; but in acute cases I have had no opportunity of forming a judgment upon it from my own personal observation.

CHRONIC ORCHITIS; OR, FUNGUS OF THE TESTICLE.

This affection occasionally succeeds acute orchitis, as a result of the inflammation when imperfectly resolved; but it is much more frequently chronic from its commencement. By far the most frequent cause of chronic orchitis is urethral disease, such as gonorrhœa or stricture, the inflammation being conveyed along the vas deferens to the epididymis. Irritation of the urethra, induced by other affections of the other urinary organs, is sometimes the exciting cause. It ought, however, to be remembered, that this disease is not invariably owing to the state of the urethra. Excessive indulgence of the passions, a reduced state of the vital powers, debility resulting from a long-continued course of mercury, are all regarded as predisposing causes. It has been sometimes known to come on during attacks of gout and rheumatism; and hence these diseases have been said to be favourable to its occurrence.

Anatomical characters.—The principal anatomical character of this disease is a yellow homogeneous deposit which does not become vascular, and which is at first soft, but ultimately becomes more solid and firmly adherent to the parts with which it is in contact. This deposit is the ordinary result of the various forms of the disease, and on it the enlargement depends. Pathologists have been anxious to determine in what textures the matter is originally deposited.

Cruveilhier, who has given an interesting description of this disease, illustrated by coloured plates, supposes that the yellow substance is originally deposited in the cellular tissue of the testis, and that it radiates along the fibrous partitions from the corpus Highmori. But although in very advanced cases it may be found in the cellular tissue, yet, from the dissections of Cooper, Brodie, Curling, and many others, it appears certain that it is originally deposited within the tubuli testis, and that it is a secretion in them by the lining membrane. It has been found in them, in the rete testis, the epididymis, and the vas deferens.

The disease may give rise to serous effusion into the tunica vaginalis, producing fluctuation; or to effusion of lymph, causing obliteration of the sac, or to ulceration of the coats of the testicle, and of the parietes of the scrotum, and to eventual protrusion, through the opening, of a yellowish, firm, comparatively painless fungus, which, being part of the testicle itself, the condition has very properly received the name of Hernia testis. In many cases, the surface of the protruded part becomes covered over with a layer of weak granulations, affording a copious discharge; but in many which I have seen, no granulations were formed. The tumour consists of the tubuli testis with the yellow deposit, the part being pressed out by the morbid deposit when resistance can no longer be offered by the coats of the testicle and the parietes of the scrotum, they having given way by ulceration. In some instances, the whole of the organ has protruded. The protrusion may or may not be preceded by slight suppuration, as well as by the yellow deposit, and sometimes pus is deposited in various parts, giving rise to abscesses and sinuses; and creating a necessity for castration.

Such are the anatomical characters of chronic orchitis, when it runs its course.

Symptoms.—The principal symptoms of this disease are, slight pain, or a sense of uneasiness, or weight in the part. The uneasiness, however, is not great, and in some instances is so slight that the disease has been known to make considerable progress before the patient has been aware of its existence. The testicle feels hard and incompressible. The hardness and pain are both greater before the coats of the testicle have given way, than afterwards. There is slight tenderness or pain on pressure at the commencement of the inflammatory process; but after the disease has existed for some time, the tenderness on pressure is very inconsiderable, and when, at an advanced stage of the disease, protrusion of the substance of the testicle has taken place, it is found to be nearly, if not entirely, insensible. If suppuration precede protrusion, the patient will exhibit the ordinary local signs of inflammation. The suppuration is always limited, as is also the softening which it induces. The general swelling usually diminishes to a certain extent when the scrotum has given way.

Treatment.—The result of treatment is usually satisfactory, if commenced at an early period. It may be said to consist in the removal of the cause of the disease, rest, a course of mercury carried to an extent sufficient to produce an impression on the system, and the careful employment of pressure by the mode already described. Mercury is the grand remedy, and in few diseases is more benefit derived from its use. Blue pill, alone or in combination with opium, as symptoms may indicate, is one of the best modes of administering it. In many cases I have used the proto-iodide of mercury in doses of a grain and a half night and morning, and with the most beneficial results. During an accession of inflammatory symptoms, local depletion by leeches may be necessary, but depletion forms no prominent part of the treatment of this disease. When protrusion has taken place, the mode of treatment now adopted is that for which we are indebted to Syme. In consists in slightly enlarging the opening through which the protrusion has taken place, removing the hard ring of integument which constitutes the margin of the opening, bringing the integument completely over the protruded part, and retaining the opposite sides of the opening in apposition by means of silver sutures, or hare-lip pins, and leaving the part without any dressing. This treatment has now been fairly tried in many cases, and, as far as I know, has been uniformly attended with the desired result. For my own part, I have been exceedingly gratified with the results of this mode of treatment. It is certainly a great improvement on the practice which formerly prevailed, namely, that of shaving off the fungus, or destroying it by escharotics, and endeavouring afterwards to heal the wound ;—a treatment, in some instances, so tedious and unsatisfactory, that castration has often been deemed more expedient.

NERVOUS AFFECTIONS OF THE TESTIS.

There are two varieties of nervous affections of the testicle, namely, "Irritable Testis, and "Neuralgia of the Testis."

Irritable Testis.—This affection, which is an increase of the natural sensibility of the organ, is usually met with in weak, irritable, dyspeptic, and hypochondriacal persons, and is for the most part dependent on some affection of the urethra, or of the genital system, or on disorder of the general health. It sometimes occurs after great indulgence in sexual intercourse, or after much venereal excitement ; and it has been known to be a consequence of onanism, and of involuntary seminal emissions. The sensibility of the organ is increased to a most painful extent, so that in some instances the part is intolerant of manipulation, and even the contact of the dress is painful. In some instances, both sides are affected, a circumstance in which morbid sensibility differs from Neuralgia of the Testis. The uneasiness is usually increased by exercise, and by the erect posture, and is sometimes so great as to oblige the patient to abstain from exercise, and to remain at rest in the recumbent posture.

In the treatment of this affection, the principal indications are, to remove the cause, to improve the general health by such means as are most judicious in the particular circumstances of the case, and to diminish the preternatural sensibility of the parts by the application of powerful anodyne lotions. Lotions containing opium, belladonna, or tincture of aconite, or combinations of these medicines, are often exceedingly useful. In several instances, this affection has been cured by complete change of scene, air, and mental occupation, without any other treatment except support of the testis.

Neuralgia Testis.—In this distressing affection there is constant uneasiness, sudden, severe, and remittent attacks of pain, occurring in paroxysms of variable duration, and generally at irregular, but sometimes at regular intervals, like other neuralgic pains. The pain is most excruciating, and during its continuance the testicle is drawn up by spasmodic contraction of the cremaster muscle, and in some instances the pain is attended with nausea and vomiting. This affection possesses the characters of tic douloureux, or true neuralgia, and is almost always confined to the spermatic nerves of one side. It is most frequently met with in weak, irritable, and dyspeptic persons, and attended with a disordered condition of the digestive organs; and the intense pain and want of rest which occur in most cases give rise to derangement of the general health. Occasionally this affection has been found to succeed an attack of orchitis, and to recur whenever the patient's health has become disordered, and in several cases it has been known to be excited by the morbid condition of the veins in varicocele: but in the great majority, the cause of the disease is exceedingly obscure; and when, on account of the severity of the pain, patients have insisted on castration, dissection has not discovered anything to account for the pain; for the structure of the testis has almost always been found to present a perfectly healthy appearance, except in some examples, in which there was a slight fulness of vessels, the effect probably, and not the cause, of long-continued pain. The disease usually yields in time to the treatment proper for neuralgia in other parts.

TUBERCULAR DISEASE OF THE TESTICLE, OR SCROFULOUS TESTICLE.

This disease sometimes occurs in children, a fact of which a considerable number of examples are recorded, and of which I have seen two, in boys of five and seven years of age; but it has been found advanced to the stage of suppuration at a still earlier period. The most common time for its appearance is at puberty, or between that period and the age of twenty. It is generally found only in one testicle, but sometimes both are affected.

Symptoms.—The patient feels uneasiness in some part, generally in the epididymis, where, on examination, enlargement and induration may be perceived. The hardness is greater than in common chronic orchitis, but less than in scirrhous affections of the testicle. In most cases uneasiness is afterwards experienced in another part, commonly also in the epididymis, and on examination another swelling with the same characters is discovered. The disease is always slow in its progress, and often appears as if stationary; but after a considerable period the enlargement becomes greater, the uneasiness increases, the integument becomes of a dark livid red colour, and adherent to the large part, and at last an abscess forms, from which pus mixed with tubercular matter is discharged. The quantity of matter discharged is not great, the abscess does not readily heal, a fistulous opening forms, through which a thin discharge, sometimes mixed with seminal fluid, continues to ooze. Sometimes hernial protrusion takes place of the tubercular matter. The slight fungus thus formed is easily distinguished from protrusion of the substance of the gland in chronic orchitis by being much softer, of less extent, and more easily broken down. From what will be stated under the head of treatment, it will be evident that the diagnosis in these cases is very important. It is not often that the whole testicle is destroyed by the disease; in the great majority of cases a considerable portion of the organ remains in a sound state. In an advanced stage of the disease the original humour may not be so easily perceived, on account of general swelling caused by effusion into the tunica vaginalis. The patient in most instances exhibits scrofulous affections in other parts.

Treatment.—The treatment is both constitutional and local. In this as in other scrofulous affections, constitutional treatment is of the first importance. The constitutional treatment proper in cases of Scrofulous Deposit has been mentioned in the chapter on Tubercle, and in various parts of this work. With regard to the local treatment, support of the testicle is indispensable in every stage of the disease. In its first stage, and when the morbid action has become chronic, painting every second day with tincture of iodine, or strapping the testicle with the emplastrum ammoniacum, are suitable local remedies. My own experience leads me to prefer painting the part with tincture of iodine in preference to any other application. When local inflammatory symptoms present themselves, the most useful remedies are, rest, elevation of the testicle, leeches, and cold lotions; and should suppuration occur, early evacuation of the matter by direct incision is important. After evacuation of the matter, it is sometimes advisable to destroy the diseased parts by means of the nitrate of silver; after which a healing action is more readily induced. Should protrusion of the tubular portion occur, the treatment of preserving the part and bringing the integument over it is not suitable, though so successful in the case of fungus in chronic orchitis; but the protruded part should be destroyed by some powerful escharotic, such as the potassa fusa, or the chloride of zinc. Sometimes the destruction of the substance of the testis is so extensive from tubercular deposit, suppuration, and sinuses, as to render ineffectual every proceeding except castration.

FIBROUS TRANSFORMATION OF THE TESTIS.

The principal symptom of this comparatively rare affection is, great induration. In some cases, the testis has been found unchanged in size; in some, slightly diminished; in others, enlarged. It is distinguished by the absence of pain or any particular inconvenience, by not being of a malignant character, and by occasioning little discomfort, except when the patient becomes alarmed, and the affection is in consequence a source of mental anxiety. I have met with only one example of this disease in my own experience; and in that I was obliged to resort to castration, on account of the patient's excessive anxiety, in consequence of which his general health had been seriously injured. The only local symptoms in this case were, great induration, slight enlargement, and a sense of weight in the affected part. When, from the above-mentioned cause, castration is deemed advisable, it may be resorted to with every prospect of success, as the disease is not of a malignant character. No treatment is of any avail.

CYSTIC SARCOMA.

Symptoms.—This rare affection, called by some hydatid disease of the testicle—an improper appellation, inasmuch as the cysts are not of the nature of animal hydatids,—is chiefly met with in the middle period of life, rarely before the eighteenth or after the fortieth year. It begins in the testis, and is unattended with pain, tenderness on moderate pressure, redness, heat, transparency, enlargement of the cord or glands in the groin, or with any constitutional disturbance, or derangement of the general system. These negative symptoms are very important to be noticed for the purposes of diagnosis. There is a swelling, the peculiarities of which are, that it increases very slowly, is usually of an oval form, has a smooth surface, and though somewhat uneven in its general outline, has none of the irregular knotted surface peculiar to scirrhus. The swelling is not so pyriform as in hydrocele, but, like the testicle itself, is compressed laterally. It feels heavy, and not only creates inconvenience by its size, but when it becomes large, causes an uneasy sensation and dragging pain in the lumbar regions, from its weight, especially when unsupported. With regard to its fluctuation, it has been well remarked,—"When the swelling is handled, it communicates an impression that it contains a fluid, for it easily yields on pressure; yet there is no true fluctuation, for the tumour does not rise at a distance, as it sinks under the pressure of the finger, but it yields only at the spot compressed." It is, in fact, more a yielding than a fluctuation. The veins of the cord are enlarged. By these marks the disease may be distinguished from hydrocele and encephaloid cancer, the only two affections with which there is any risk of confounding it.

Anatomical Characters.—The testicle consists of cysts varying much in number, size, thickness of their parietes, and nature of their contents. At an early stage of the disease there may be only a few, but at an advanced period they are almost innumerable; they are small and vascular at first, and contain a transparent fluid. As the cysts increase, the secreting structure of the testicle becomes atrophied and removed, and often wholly destroyed; the cysts increase in number, thickness, and size; and their contents, instead of remaining transparent, become viscid, thick, albuminous, and often present the appearance of a mucous secretion. The contents of the cysts present at least as great varieties as the size and thickness of the parietes in which they are contained, the latter becoming sometimes exceedingly dense and firm. The tunica albuginea and tunica vaginalis become thickened, and the surfaces of the latter more or less adherent.

Treatment.—Castration is the only proceeding attended with any advantage, and as the disease is not of a malignant nature, the results of that operation are almost invariably satisfactory. In some exceedingly rare instances, medullary disease has been found combined with the affection; in such cases an operation is quite unsuitable, inasmuch as it cannot save life.

ENCEPHALOID CANCER OF THE TESTIS.

This malignant disease, described under the names of soft cancer, fungoid disease, fungus hæmatodes, medullary sarcoma, pulpy testis, and encephaloid cancer, is by no means uncommon; and, although no age can be said to be exempt from it, many instances of it being recorded even in children and young persons, yet it much more frequently occurs between the ages of eighteen and thirty-five than at any other period of life.

Symptoms.—For the purpose of diagnosis, the peculiarities of the different symptoms must be minutely observed. Swelling is the earliest symptom: it begins in, and is for some time confined to, the testicle, and while so confined is globular, being somewhat of the shape of an orange, instead of being compressed laterally, as the testicle in the normal state is. It is rather hard at first, pretty uniform in its general outline, and entirely destitute of fluctuation. As the disease advances, the epididymis becomes involved, and there may occur slight effusion into the tunica vaginalis, constituting the condition called by some hydrosarcocele; and when the disease has advanced thus far, the swelling may be less flattened laterally, and present more of the pyriform shape of hydrocele. As the disease advances still further, the cord and the glands in the groin become affected, and at last firmly adhere to the surrounding parts. The swelling of the testicle, as has been already stated, is at first round and regular; afterwards it becomes uneven, and on examination feels elastic, which is very deceptive, and, unless examined carefully, may be mistaken for fluctuation. If the surgeon be induced by this symptom to make a puncture, blood only escapes. In the early stage of the disease, the integument is free from discoloration, and does not adhere to the swelling; in the next stage, it still does not adhere, and has a natural appearance, but the veins in it are varicose; and in the third stage, the integument is involved, adheres to the tumour, and presents a dark livid discoloration; and if the patient do not very soon fall a victim to the disease, the integument at last ulcerates, and a fungus, which frequently bleeds, starts up and increases rapidly. It is unusual, however, to see this fungus, as the disease generally proves fatal by the constitutional symptoms, before it arrives at that stage. The pain at first is not constant, but ultimately becomes very severe, and in the cases which have come under my own observation, the patients have described the pain as a most distressing feeling of weight, as if a heavy body rested on the testicle. In some instances, the tumour in the loins is exceedingly painful; but in others, it gives rise to comparatively little uneasiness—a circumstance which Brodie supposes to depend on the fact that the tumour sometimes presses on the nerves, and is sometimes in a measure removed from them. The pain in the testicle and in the loins is in some cases most distressing. The extremity on the affected side becomes swelled and œdematous; in some instances the glands in the opposite groin become affected; and the scrotum, glands of the groin, integument, and pubes, all become firmly adherent to each other, and in a measure all involved in one diseased mass. It is very rare for both testicles to become affected, and, singular as it is, one testicle is often found to all appearance perfectly sound, while the scrotum around it is completely involved in the disease of the opposite side. The disease increases very rapidly, the appetite fails, the countenance is sallow, the body becomes very rapidly emaciated, and the patient falls a victim to the symptoms of cancerous cachexia.

Such are the principal symptoms of this most distressing and incurable disease, of whose histological characters, progress, and results, a description will be found in the chapter on Carcinoma.

SCIRRHUS OF THE TESTICLE.

This is a very rare disease, and as yet no case of it has come under my observation, either in public or private practice. Sir Astley Cooper says he has seen but a few examples, and gives the following description of it:—"A truly scirrhous affection of the testicle begins in the body of it, with an extremely hard swelling, which may immediately inform the surgeon of the nature of the disease. It feels like a marble body lodged within the scrotum, and it is tuberculated on its surface. It sometimes begins in the centre of the testicle, and gradually extends until the whole is involved in the disease. The epididymis next becomes the seat of the disease, that portion being first attacked which communicates with the vas deferens. The spermatic cord becomes enlarged, and tubercles of various sizes form upon it. After the spermatic cord has become enlarged, a hard tumour forms beneath the emulgent artery, which may be felt through the abdominal parietes. In true scirrhus the testicle does not become enlarged to any considerable size. After the swelling in the loins, the thigh becomes enlarged and œdematous on the side of the disease, which arises from the obstruction to absorption; and the pressure on the veins may also have influence in producing this effect." Prognosis is as unfavourable here as in examples of scirrhus in other situations. The common and microscopic characters of fibrous carcinoma are described and delineated in the chapter on Tumours.

EXCISION OF THE TESTICLE.

The hair having been shaved from the pubes, the patient having been brought under the influence of chloroform, and placed in the recumbent position, with the thighs separated, the surgeon with his left hand grasps the tumour behind, so as to make the integument tense in front, and then makes two elliptical incisions, extending from the external aperture of the inguinal canal to the under part of the swelling, and embracing between them as much integument as it may be necessary to remove with the view of preventing redundancy after the operation. Due allowance, however, must be made for the integument drawn from surrounding parts, resiling after removal of the tumour. The cord should then be exposed, firmly grasped by an assistant, and cut through as low down as may be compatible with the entire removal of the disease. The operator takes hold of the under portion of the cord, and with a few movements of the knife extirpates the testicle. The vessels of the cord having been tied, as well as any other vessels that may be found to bleed, the edges of the wound are approximated, dressed according to approved principles, and supported by a T bandage. The under part of the wound hardly ever heals except by granulation, and on that account it can answer no useful purpose to approximate the edges closely below.

HYDROCELE.

We shall refer to five forms of hydrocele; namely, three of the tunica vaginalis, and two of the cord. The former is named simple hydrocele of the tunica vaginalis testis, congenital hydrocele of the tunica vaginalis, and encysted hydrocele of the testis; and the latter, diffuse and encysted hydrocele of the cord.

I. SIMPLE HYDROCELE OF THE TUNICA VAGINALIS TESTIS.

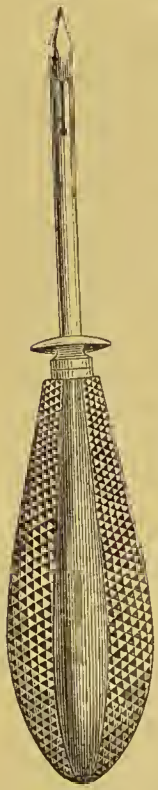
Symptoms.—There is swelling, which is generally round at first, but as it increases it assumes a pyramidal form, with its larger extremity downwards, the upper extending as the disease advances, as high as the inguinal canal. When the swelling is very large, the upper extremity expands considerably, and loses the narrowness of its form. If the hydrocele be large, the scrotum, owing to its great distension, loses its natural wrinkles, and assumes a glazed appearance; and in consequence of the integuments being drawn upon the tumour, the penis seems contracted, and the raphé of the scrotum is, as it were, pressed to the opposite side: the swelling feels much lighter than a tumour of the same size caused by disease of the testicle. Besides its form and lightness, the swelling has another character which it is of importance to observe, as it assists in making out the diagnosis between hydrocele and hernia—it commences at the under part of the scrotum, and increases from below upwards; whereas a scrotal hernia commences from above and extends downwards. The history of the symptoms thus becomes useful for assisting the diagnosis.

Fluctuation is usually another symptom of hydrocele, but it is sometimes not easily perceptible, when the scrotum is very greatly distended; and its absence is not a proof that a tumour is not hydrocele.

Another symptom is transparency, the presence of which is a sure proof of hydrocele. On this subject, Pott remarks:—"The absence of transparency is not a proof that a tumour is not a hydrocele;" and Professor S. Cooper observes that—"Although the absence of transparency is not a proof that a tumour is not a hydrocele, yet its presence is an infallible test that it is." According to Sir A. Cooper, we never fail, on proper examination, to discover transparency in such hydroceles as are formed in this country; but in persons who have had hydrocele formed in warm climates, the parietes of the scrotum are sometimes rendered so thick as to be no longer transparent. Two cases have come under my own observation, in which it was impossible to discover any transparency; the one in private practice, the other in a patient under my care in the Royal Infirmary, Aberdeen. In each case the fluid was of a greenish-black colour, and very grumous; and to this condition, in both instances, I referred the absence of transparency. In the situation of the testicle the tumour is always opaque. In common hydrocele another symptom useful for diagnosis is, the free state of the cord; in hernia the cord is covered by the swelling, but in hydrocele it can be felt free in the inguinal canal. Another symptom of a tumour being a hydrocele is, its freedom from pain or tenderness under ordinary circumstances, or even on pressure, except at the testicle, where there is slight tenderness on pressure; but at other parts there is no tenderness, and beyond inconvenience from its bulk and a sense of weight, the swelling gives rise to little or no discomfort.

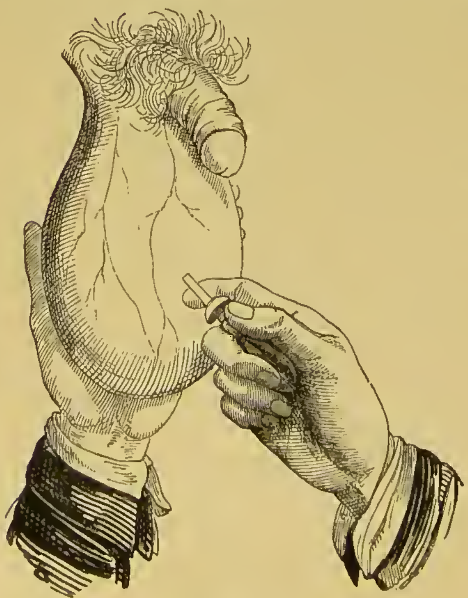
State of the parts.—The swelling is caused by a fluid which is usually transparent, and of an amber, pale-yellow, or straw colour, sometimes, though rarely, of a greenish or blackish-green colour. Sometimes it is thick, and of a grumous appearance, and occasionally it contains a quantity of flaky matter, composed chiefly of albumen; and in some instances, more especially in old persons, the fluid contains cholesterine in the form of minute shining particles. The seat of the fluid is the tunica vaginalis, which in most instances is transparent and simply distended; but sometimes it is thickened, and occasionally, in consequence of previous adhesions, it presents a sacculated arrangement, constituting what is called a multilocular hydrocele. The usual situation of the testicle is at the back of the swelling and below its middle; and this is the situation in which, from its natural relations, it might be expected, as it is not in the normal condition of the parts adherent to the surrounding parietes laterally or anteriorly, but only posteriorly: but in some cases, in consequence of adhesions having been contracted between the tunica vaginalis propria and the tunica vaginalis reflexa by inflammation previous to the occurrence of hydrocele, it is found in the front or in other parts of the swelling. It is, of course, of much practical importance to ascertain the situation of the testicle, that it may be avoided in the operation; the opacity, and the tenderness and doughy feel on pressure will indicate its position.

Fig. 229.



Treatment.—The treatment adopted in all cases, except those of children, is by operation, and that of two kinds—palliative and radical; the former consisting in merely drawing off the fluid by tapping, the latter in doing this, and also in using means for the purpose of inducing such changes as may prevent the return of the fluid. The radical treatment by injection is thus performed:—The patient should be placed erect; the surgeon should with his left hand grasp the tumour behind, so as to render it prominent and tense in front, and with his right hand send the trocar and canula through the parietes, holding them perpendicular to the surface until penetration be effected, and then directing them obliquely upwards, so as to diminish the danger of wounding the testicle. The trocar having been withdrawn, and the fluid allowed to escape, the injection of tincture of iodine and water is thrown into the canula by means of a glass syringe, fitted to the canula by means of a nozzle of silver, platinum, or palladium. The injection is allowed to remain, until the patient feels pain in the loins or testicle, when it is withdrawn. The time varies in different persons; in adults it is usually from four to seven minutes; but in all cases, so soon as the patient begins to feel pain in the testicle or along the course of the cord, the injection is withdrawn. In addition to the pain, patients

Fig. 230.



From Liston.

often experience a feeling of faintness and sickness. The fluid having been withdrawn, the patient should be put to bed, the testicle supported, and the after treatment regulated according to the character of the supervening symptoms. If no symptoms of inflammatory action present themselves, the patient should be induced to move about, and be allowed a generous diet, and the scrotum should be gently compressed and handled so as to occasion friction between the surfaces of the tunica vaginalis; but if the inflammation threatens to be excessive, or so great as to render suppuration probable, rest, low diet, support of the testis, and the ordinary treatment for acute orchitis should be enjoined. The tumour usually returns very quickly, and often acquires the size of the hydrocele previous to the tapping; but in the course of twelve or fourteen days, under proper treatment, the parts generally resume their usual size. At one time it was supposed that injection effected a radical cure by the obliteration of the cavity of the tunica vaginalis caused by complete adhesions of the surfaces of that membrane; but it is now known that, although the serous surfaces are sometimes united, this state is not essential, that more commonly the adhesions are only partial, and that the cure is produced by an alteration in the secernent function of the membrane. Many different kinds of fluid have been used for injection. Tincture of iodine either alone in very small quantity, or mixed with water in the proportion of one part to three, port wine, and the solution of sulphate of zinc were favourite injections; but the tincture of iodine alone or diluted with water is now generally preferred. Mr. Martin was the first who tried iodine injections. His proceeding was, to use one part of the tincture to three of water, to inject only a very small quantity, and to allow it to remain; and the result of this practice was, that of two thousand three hundred and ninety-three cases treated at the native hospital of Calcutta, the failures were under one per cent. The use of iodine injections has since been tried by surgeons in most parts of the world, and with satisfactory results. Some use a very small quantity of the tincture alone, and allow it to remain. Others, and perhaps a larger number, use the injection of the strength employed by Mr. Martin, and allow it to escape. My own experience induces me to prefer the practice of throwing in about two drachms of the tincture, and allowing it to remain.

In children it is not advisable to have recourse to injections; neither is it necessary, as the swelling is in most cases easily dispelled by the application of discutient lotions; and when this treatment is not found to produce the desired result, simple puncture with the lancet, and escape of the fluid, are usually followed by a radical cure.

In two other conditions injection is not advisable; namely, when the testicle is diseased, and when, though it is sound, the hydrocele is very large. In the latter case, the most prudent method of proceeding is to evacuate the fluid by tapping, to allow its re-accumulation until the hydrocele attain a moderate size, and then to proceed with tapping and injection.

Various other methods of treatment have been employed for effecting a radical cure, as incision, excision, caustic, silver or iron wire, seton, and acupuncture; but as these methods are not so satisfactory, it is unnecessary to describe them.

II. CONGENITAL HYDROCELE OF THE TUNICA VAGINALIS.

This differs from common hydrocele, inasmuch as the fluid communicates with the cavity of the peritoneum by a vaginal process of that membrane, within the inguinal canal. In this variety, injection must never be employed while the communication remains, as peritonitis might result from the extension of the inflammation to the abdomen. The first indication is, to obliterate the tubular communication with the abdomen: and the best means for this purpose is gentle pressure by the use of a truss. After the obliteration has been accomplished, the tumour is often dispelled, in children, by the use of discutient lotions, and in adults, the usual treatment of injection may be employed. The only judicious operation in any case before obliteration is, the simple drawing off of the fluid.

III. ENCYSTED HYDROCELE OF THE TESTIS.

In this form the fluid is contained in a cyst, or cysts, distinct from the cavity of the tunica vaginalis. These collections present the three following varieties:—*first*, they occur, and that most frequently, below that part of the tunica vaginalis which covers the epididymis; and the cysts differ greatly in size, number, and form, being in some instances small and pressed into the epididymis, while in others the tunica vaginalis is raised up by them, and they assume a pendulous, pedunculated form, and in others again, they become large, but remain connected with the epididymis by a broad base; *secondly*, they occur between the tunica albuginea and the tunica vaginalis testis; in this, which is the rarest form of all, the cyst is usually single and of small size; and, *thirdly*, between the layers of the loose or outer portion of the tunica vaginalis.

In encysted hydrocele the tumour should not be interfered with, unless it become troublesome from pain, or inconvenient from its size. When interference is deemed advisable, the most judicious proceeding is merely to draw off the fluid by simple puncture. If the tumour should return, and it be thought advisable to endeavour to effect a permanent cure, as the treatment by injection has not been found to succeed so well as in common hydrocele, the preferable treatment, especially when there is a number of cysts, is the use of a seton, which should be introduced and retained until consolidation be effected.

HYDROCELE OF THE CORD.

Of this affection there are, as has been already stated, two varieties; namely, diffuse and encysted.

I. DIFFUSE HYDROCELE OF THE SPERMATIC CORD.

This exceedingly rare variety consists of an albuminous fluid of a white or yellowish colour, diffused throughout the cellular tissue connecting the vessels of the spermatic cord. This tissue is surrounded by a cellular sheath; and this sheath, again, is invested by an expansion of the cremaster musçle and the coverings of the cord external to it. The affection is of the nature of simple œdema; the cells, however, are so greatly distended as to be converted into large vesicles. In some instances, at the lower part of the tumour, the cells disappear, and the fluid at that part is contained in a single cavity, where it forms a swelling attended with fluctuation.

Treatment.—While the swelling is small and unattended with particular inconvenience, the most judicious course is not to interfere with it. When interference becomes necessary, the best mode of treatment is acupuncture. The punctures are made at the under part of the swelling, and need not be numerous. The fluid escapes into the cellular tissue of the scrotum, and is soon removed by absorption. This mode of treatment is unattended with danger, whereas free direct incision into the distended cells is not so.

II. ENCYSTED HYDROCELE OF THE SPERMATIC CORD.

The symptoms of this variety are a swelling, slow in its growth and painless, usually of an oval form, moveable on the cord, attended with fluctuation, and in most instances distinctly transparent. The tumour is generally circumscribed, and the testis can be felt separate. This affection is most common in infants, but it is met with at all periods of life. The fluid is sometimes of a straw colour, but more frequently limpid, and contains little or no albumen. Occasionally more cysts than one are found; but this is unusual, the fluid being generally contained in a single cyst. This cyst is in most cases formed of an obliterated portion of the vaginal process of peritoneum drawn down at the period of the descent of the testicle; sometimes, however, the cyst is an adventitious formation. It is imbedded in the cellular tissue connecting the vessels of the cord with each other, and is embraced by the other coverings of the cord.

In children, this affection usually disappears under the use of applications calculated to promote absorption, as in simple hydrocele at the same period of life; and in adults, if interference be necessary, the cure may be accomplished either by tapping and injection, or by the use of a seton.

CHAPTER XXI.

AFFECTIONS OF GENITO-URINARY ORGANS.

GONORRHŒA.

The essential and characteristic symptom of gonorrhœa is a purulent or muco-purulent discharge from the mucous membrane of the genitals. Gonorrhœa may be either *simple* or *venereal* ; the former being caused by some local or constitutional irritation, the latter by the direct application of a specific irritant.

SIMPLE GONORRHŒA.

If it arises from simple local or constitutional irritation, such as teething, the use of bougies, or derangement of the digestive organs, the only symptom will be a purulent discharge of a whitish colour from the urethra, for the most part unaccompanied with heat, pain, or ardor urinæ ; but if it is a precursory symptom of gout or rheumatism, in which case it is called arthritic gonorrhœa, the presence of symptoms of local inflammation and of ardor urinæ will render the diagnosis between it and virulent gonorrhœa extremely difficult. The discharge, which in the case of gout or rheumatism arises from a superabundance of uric acid in the urine, will disappear immediately upon the development of the disease itself. A purulent discharge from the male urethra is sometimes occasioned by lithic or oxalic gravel, or by the use of particular medicines, as guaiacum or Cayenne pepper. Arthritic gonorrhœa on the approach of an attack of gout or rheumatism, and gonorrhœal rheumatism of a most severe character towards the decline of virulent gonorrhœa, are well known to practical observers. In this affection scarcely any special treatment is required, the removal of the cause of irritation being generally quite sufficient ; but if necessary, recourse may be had to mild injections, laxatives, and such remedies as the state of the body may indicate. Sir A. Cooper has in his lectures strongly pointed out the importance, in a medico-legal point of view, of distinguishing accurately between this and the venereal or virulent form of the disease, especially in cases where it is asserted that a rape has been committed on very young children ; the only ground of such accusations often being the existence of a discharge from the vagina of the child. The possibility, therefore, of this being of a harmless nature, and not the consequence of sexual intercourse, must always be kept in mind.

VIRULENT, OR VENEREAL GONORRHŒA.

Cause.—This form of gonorrhœa is produced by the application of a specific irritant or virus to the surface of the mucous membrane of the genitals, such application occurring usually during sexual intercourse.

Nature of the Virus.—This virus is essentially distinct from that of syphilis. The experiments of John Hunter seem, indeed, to disprove this; but M. Ricord of Paris has completely set this question at rest by his numerous and well-conducted experiments, which have been repeated by many others with similar results. Out of five hundred and forty-nine cases, occurring in his male and female wards, of gonorrhœa uncomplicated with chancre, and one hundred and twelve cases of chronic gonorrhœa or gleet, all of which were subjected to the test of *inoculation* in other parts of the body, *not one* produced the characteristic pustule which he invariably found to result from inoculation with matter from chancre in any of its forms during the period of infection. The circumstance of gonorrhœal matter having by inoculation produced chancres in the experiments of Hunter and others, M. Ricord attributes to the presence of concealed chancres (chancres larves) in the urethra, which he has shown to be a frequent complication. It is right, however, to state that the late Mr. Carmichael of Dublin continued to adhere to the opinion, that gonorrhœa virulenta produces the same constitutional effects, and is therefore identical in its nature with that mild form of chancre which precedes the papular eruption. But in his lectures, whilst treating upon this subject, he has not taken into consideration the possibility of the existence of concealed chancres, which, if acknowledged in the five cases quoted by Carmichael in support of his own theory, would reconcile his view with that generally received, namely, that the gonorrhœal virus is essentially distinct in its nature and effects from that of syphilis, and that the two diseases are not capable of reproducing one another.

Period of Development and Duration.—The time at which the discharge first makes its appearance varies, but is generally from the *fourth* to the *seventh* day after infection. Occasionally it shows itself earlier, even in twenty-four hours, of which Sir A. Cooper mentions an instance; sometimes after a much longer period. In this latter case, however, it is often retarded by the coexistence of the premonitory symptoms of another disease, such as fever, on the recession of which disease it may immediately appear. Its *duration* is very variable, and cannot be predicted from either the nature or the severity of the symptoms. It often runs its whole course in a few weeks; at other times it lingers on for months, or even years, constituting what is termed gleet.

The following additional facts respecting gonorrhœal infection appear to be well established :—1. The disease is not communicable by sexual intercourse *before* the discharge appears. 2. After the discharge is established, if the urethra be previously washed out by means of a syringe, it is not probable that the disease will be communicated. 3. The matter possesses the power of infection for an indefinite period. Titley records the case of a girl communicating the disease on the first night after her leaving the Magdalene, where she had been for twelve months; and Hunter mentions the case of a girl who did so after having been in the Magdalene for two years. 4. Two people having gleet may have intercourse with impunity; but either of them will communicate gonorrhœa to a sound person. 5. The violence of the symptoms depends much upon the habit of body, the scrofulous diathesis greatly increasing their severity;—thus, the same woman may give a very mild form of the disease to one man, and a most severe form to another. 6. The first attack of the disease is always the most violent. 7. The disease is now much milder than formerly.

Symptoms.—At first there is merely a slight uneasiness and swelling along the anterior and under portion of the penis, with a tickling, teasing sensation over the glans and anterior portion of the urethra, the lips of which are found to be slightly red and turgid. Upon squeezing the glans a small quantity of a whitish muco-purulent matter exudes. In a few days, the time varying according to the irritability of the constitution, the uneasy tickling sensation gives place to pain, which is often remarkably severe. There is an abundant discharge of yellowish pus, with scalding pains (ardor urinæ) during micturition, the calls to which are very frequent. The urethra, in consequence of the inflamed state of the mucous membrane, is much narrowed, causing the urine to be voided in a stream much smaller than usual, and sometimes forked, by reason of bands of lymph stretching across the interior of the canal. There may also be painful erections during the night. The pain progressively increases, and the matter discharged becomes greenish, or perhaps mixed with blood; and besides the painful erections, chordee may now supervene. This term is given to a distorted condition of the penis, in which it is curved downwards or to one side during erection, owing to the circumstance that inflammatory effusion into the corpus spongiosum prevents equal expansion with the corpora cavernosa. The inflammation may extend externally over the glans, producing in it a peculiar cherry colour, with extreme pain, and also over the membrane lining the prepuce, causing effusion into the cellular tissue between it and the integument, narrowing the external orifice, and giving rise to phymosis; or, if the prepuce had been previously retracted, to paraphymosis. This is the general progress of a moderately severe attack of gonorrhœa. In some cases, however, the inflammation extends along the course of the lymphatics to the inguinal glands, there causing bubo; or backwards along the urethra to the membranous or prostatic portions, the neck of the bladder, or the bladder itself; or the testicle may become involved, in consequence of the inflammation extending along the vas deferens, or metastasis.

Treatment.—The progress of gonorrhœa may be divided into *three* stages—the *inflammatory*, the *suppurative*, and the *chronic;* in each of which an entirely different mode of treatment is indicated. Some short time, however, generally intervenes between the first appearances of the gonorrhœal discharge and the accession of the inflammatory stage, and it has been recommended, upon high authority, to take advantage of this interval and check the disease at once, by throwing into the urethra strong injections of the nitrate of silver—ten grains to an ounce of water. This plan, however, is no doubt attended with considerable risk, as it may excite high inflammation of the urethra extending perhaps to the bladder. Titley and Carmichael agree in strongly deprecating the practice; Ricord, Arnott, and many others, strongly recommend it. It is called the *ectrotic* or *abortive* treatment, to distinguish it from the *curative;* and the time for its adoption is limited to the nascent period of the inflammation,—the object aimed at being to prevent the development of the disease. Dr. Arnott's mode of employing this treatment is as follows:—About a couple of drachms of a solution of the nitrate of silver, in the proportion of twelve grains of the salt to an ounce of water, is thrown into the urethra by means of a glass syringe; the penis being at the same time elevated and compressed about two inches from the orifice, thus ensuring complete application of the solution to the urethral membrane within this range, and no further. The solution is retained within the urethra for less than half a minute, and no urine is to be passed for half an hour after the injection. The immediate visible effect of the application is the formation of a coagulated film on the surface of the urethral membrane; and the diminution of pain which the patient experiences during micturition is probably to be attributed to the protection thus afforded to the abnormally sensitive membrane. It is also thought that the effects of the application may be partly attributed to the well-known action of the nitrate of silver in subduing crescent inflammation. Arnott thinks that this proceeding is open to only one objection, namely, that the period of its applicability is limited to a stage of the disease which usually excites but little attention. Ricord, while he advocates the adoption of the abortive treatment, admits, as the result of his own experience, that although it has many advantages, it has its drawbacks and unpleasant consequences. He recommends that the urethra should not be compressed during the injection, and that the abortive treatment should also include the internal use of copaiba and cubebs in large doses. Injections modify and create a new action in the mucous membrane, and copaiba and cubebs, by yielding their principle to the urine, contribute powerfully to render that modification more effective. In the female syphilitic ward of the Royal Infirmary of Aberdeen, I have not had opportunities of trying the effect of the ectrotic treatment, because the period for its employment is over before patients present themselves for admission; but my opportunities of forming an opinion from personal observation in males, in private practice, have been sufficiently numerous to enable me to arrive at a decided conclusion. In the cases in which I have employed it, I adopted Arnott's method, and had every reason to be satisfied with the results. If the disease remain and progress after one, or at most two injections, the continuance of this treatment must be deemed unadvisable.

With regard to curative treatment, an entirely different mode is indicated in each stage.

I. *Inflammatory Stage.*—A suspensory bandage should be used from the commencement. Rest, attention to cleanliness about the parts, tepid fomentations or hip-bath, low diet, abstinence from all stimulating drinks, a smart cooling purgative at the commencement, and afterwards the use of antimonials in nauseatory doses, must be strictly enforced. During this stage, the treatment must be entirely antiphlogistic, the activity of the measures being proportional to the intensity of the inflammation. The patient should drink largely of diluents, such as barley-water, linseed tea, solution of gum arabic, containing a little nitre or carbonate of potass in solution. These tend to diminish the irritating quality of the urine, and thus modify some of the distressing symptoms. To mitigate the ardor urinæ, if very severe, about twenty drops of liquor potassæ with thirty drops of tincture of hyoscyamus, or five grains of ext. conii, may be given in camphor mixture, three or four times a day, with much benefit; emollient fomentations being at the same time applied to the penis. If painful erections or chordee supervene, a most efficient remedy is camphor with opium, which may be given in the form of pills at bedtime. During the attacks, *cold* should be applied to the penis and the feet. The paroxysm is often checked by the patient getting out of bed, and putting his feet upon the cold floor; but if these means do not succeed, an opiate enema should be given, or a grain or two of solid opium introduced within the rectum. The bowels must be kept moderately open, by means of saline purgatives; but smart purging is to be avoided, because irritation of the rectum increases the pain of the urethra. The symptoms of this stage often improve very rapidly, in consequence of taking three or four times a day a powder of ¼th of a grain of tartrate of antimony, 5 grains of nitre, and ʒj of sulphate of magnesia, dissolved in water. By these means the inflammatory symptoms, even if of considerable severity, may be subdued; but in most cases, such active treatment is unnecessary. The inflammation is generally slight, and in a few days gives way to rest, cleanliness, low diet, the free use of antimonials, liquor potassæ, demulcent drinks, with fomentations and support of the parts. The treatment must then be altered, and such remedies adopted as act favourably upon the inflamed mucous membrane.

II. *Suppurative Stage.*—The inflammatory symptoms being much checked, and the discharge having assumed a purulent character, even if considerable ardor urinæ be still present, the use of copaiba or cubebs should be commenced, the antiphlogistic regimen and rest being at the same time strictly enforced. These medicines seem, by the principle they yield to the urine, to exert a favourable action upon the urethra itself; since, when the seat of gonorrhœa is the glans, vagina, or vulva, they appear to be of no service. The balsam of copaiba should be given in capsules. Cubebs when *fresh ground* and *pure* are undoubtedly of great service in this disease. They may be given two or three times a day in water or milk, in doses of half a drachm, increased afterwards to one or two drachms, a grain or two of nitrate of potass being often added advantageously. If the discharge is not suppressed in eight or ten days, the cubebs will have no effect, and may be discontinued. In successful cases the beneficial results generally appear in two or three days, and may be known by the discharge first assuming a *ropy* character, and then ceasing altogether.

Injections.—A considerable number of days must be allowed to elapse after the subsidence of the inflammatory symptoms before injections can properly be used; then, however, they are often of the greatest service. Those most in use are, solutions of the diacetate of lead, sulphate of zinc, and nitrate of silver; the last is the most efficient, but must be used very cautiously at first, commencing with a quarter of a grain to an ounce of water, and gradually increasing it to one or even two grains. The diacetate of lead and sulphate of zinc may be used to the extent of two grains to the ounce from the very commencement, that quantity being gradually increased, if necessary. These injections should be used two or three times a day; if, however, they cause pain, they must be diluted; and if the discharge should stop suddenly, or irritation of the urethra be excited by their use, they must be altogether discontinued. By persevering in the use of these remedies, the gonorrhœa in most cases gradually disappears. To prevent its return, the injections must be still used for some days, though with less frequency, and of diminished strength, and after that time they may be entirely discontinued. In some instances, however, the discharge still continues, assuming a chronic form, and constituting gleet.

III. *Chronic Stage,* or *Gleet.*—All inflammation has now disappeared, but the discharge continues, accompanied perhaps with slight ardor urinæ; or if it ceases for a few days, it returns again and again without any apparent cause. This state may depend upon relaxation, or perhaps upon the presence of stricture. If the latter be detected, it must be treated accordingly. In this stage the use of injections must be continued, their strength being increased, if necessary; and if they are *frequently changed*, the desired effect is so much the more likely to be produced. M. Ricord strongly recommends an injection of a solution of iodide of iron, commencing with one grain to an ounce of water, and increasing it gradually till it has some effect upon the discharge. This remedy I have found very useful. Generous diet, good living, tonics, perfect chastity, and cold ablutions are useful remedies in this stage; but perhaps the best treatment is to pass a metallic bougie every second day, following up its use by that of stimulating injection. This proceeding at first sometimes increases the discharge, but its quality is speedily altered, and at length it ceases altogether. The least irritation or irregularity of life is, however, very apt to induce its return. Cantharides, taken internally, in the form of tincture, are often of great service, and may be given in doses of fifteen or twenty drops, twice or thrice a day. This dose should be increased until pain and slight strangury be excited in the urethra and neighbourhood of the pubes. The discharge will then be found to have assumed a purulent character, and will gradually subside as the medicine is discontinued. It has been well stated—"The remedies for gonorrhœa are threefold: first, antiphlogistic measures to get rid of inflammation; secondly, certain medicines containing a volatile oil, which has a peculiar sanatory influence on the inflamed mucous membrane; and, thirdly, astringents to check the secretion of the inflamed surface."

GONORRHŒA IN WOMEN.

Seat of the Disease.—The discharge may be chiefly from the mucous membrane of the labia, nymphæ, and other external parts, constituting vulvitis of some writers, and corresponding with balanitis in the male; or from the vagina, or from the mucous membrane of the os and cervix uteri, or more or less from several or all these parts. The most common seat of the disease is the vulva and vagina, and, judging from my own observation, the urethra is the rarest. Out of 250 patients in the female lock ward of the Aberdeen Royal Infirmary, only 9 had the urethra affected. Occasionally the disease is believed to extend into the cavity of the uterus, and thence along the Fallopian tubes and ovaries, presenting an analogy with gonorrhœa in the male, producing epididymitis. Such an extension, however, is very unusual.

Symptoms.—The latent period is shorter than in the male, owing to the greater extent of surface to which the poison is applied. Heat, itching, smarting, swelling, and redness are early symptoms, and they are soon followed by pain, and a discharge, at first muco-purulent, and soon becoming thick, acrid, fœtid, and sometimes bloody. Along with these symptoms the patient is distressed with pain and scalding, during micturition, if urethritis or vulvitis be present. In the present state of our knowledge we have no certain means of distinguishing the inflammation and the discharge of gonorrhœa from inflammation and discharges arising from idiopathic causes. We have no microscopic or chemical tests to enable us to distinguish the discharge of gonorrhœa from that arising from other causes; and with regard to symptoms, the only differences may be said to be, that in gonorrhœa they usually occur more suddenly, are more difficult of removal, and affect a greater extent of membrane, than in inflammation arising from other causes. These differences, however, in the absence of reliable history of the case, furnish only presumptive evidence for diagnosis. The discharge stains the patient's linen of a greenish-yellow colour, and is often very abundant. Upon examination with the speculum, redness is observed to be very diffused, and of a fiery hue, and superficial excoriations are often perceived upon the cervix uteri, or within the vagina. Sometimes infiltration takes place to a considerable extent into the cellular tissue of the labia and surrounding parts, causing great œdema, and occasionally abscess and sloughing in these situations. The glands in the groin are also at times affected. If a case come under treatment *before the commencement* of the inflammatory stage, the urethra not being involved, it may be checked at once by injecting a solution of nitrate of silver, of the strength of half a drachm to an ounce of water; but as this is seldom the case, the antiphlogistic treatment must be employed until the inflammatory symptoms have subsided, warm emollient fomentations and injections being also used, if the pain is severe. Should abscess of the labia or external parts ensue, the matter must be evacuated as speedily as possible by a large opening. As soon as the inflammation is subdued, astringent and stimulating injections should be employed. Solutions of sulphate of zinc or alum of considerable strength are of great service; but perhaps the most useful is a solution of nitrate of silver, two or three grains to the ounce: the solution should be injected frequently; or, which will be found still more efficacious, the vagina should be plugged with lint dipped in it, and changed two or three times a day. This plan, recommended by both Ricord and Carmichael, seldom fails to check the discharge very shortly; it seems to answer two purposes, both acting as a local astringent, and separating the parietes of the vagina, thus removing a constant source of irritation to the sound parts, and insulating the diseased portions. There are few things more important in the local treatment than keeping the parts separated from each other. In many cases a tent of lint, wet with solution of acetate of lead, sulphate of zinc, or sulphate of alum, will be found to have all the good effects that can be wished. It often happens, however, that notwithstanding these applications, the discharge still continues. In this case the speculum should be used, and the os uteri examined as it is often found that excoriations or ulcerations exist at this part, which by their constant irritation keep up the discharge. If such be discovered, they should be cauterized with a pencil of nitrate of silver. This M. Ricord recommends also to carry gently over the vagina itself. This plan will seldom be found to fail. If the urethra be the chief seat of the disease, the same principles of treatment are applicable as for gonorrhœa in the male.

EXTERNAL, OR SPURIOUS GONORRHŒA.

Balanitis of some authors, Gonorrhœa Præputialis of others, are terms used when the gonorrhœa proceeds only from the glans penis, or from the lining membrane of the prepuce. Rest, moderate diet, and cleanliness are often sufficient of themselves to remove this affection; if not, and if no phymosis exist, the prepuce should be drawn back and the parts gently cauterized with a pencil of nitrate of silver, this being repeated every two or three days, till the cure is effected. If, however, phymosis be present, accompanied with considerable inflammation, leeches must be applied to the groin, and emollient fomentations to the affected part; and as soon as the inflammation has been subdued, the proper operation must be performed for removing the phymosis, as it tends to keep up the discharge by constant irritation. Should any treatment be necessary after this, the gentle cauterizing of the part as above directed, or the application of a strong solution of nitrate of silver between the glans and the prepuce will check the discharge. Copaiba and cubebs seem to have no influence on this form of gonorrhœa.

INFLAMMATION OF THE MEMBRANOUS PORTION OF THE URETHRA.

Inflammation of the membranous portion of the urethra is often the consequence of an attack of gonorrhœa. When this occurs, the symptoms become more marked, especially the ardor urinæ; the whole penis is much swollen; the patient is exceedingly distressed with chordee; the discharge becomes fœtid, sometimes tinged with blood; any pressure upon the membranous portion of the urethra causes pain as far back as the anus; the testicle is usually tender, and sometimes swollen. Local bleeding, the application of poultices and fomentations to the perineum, and other antiphlogistic remedies, proportioned to the urgency of the symptoms, constitute the treatment to be employed; and, if matter form, a free vent must be given to it externally, as soon as its presence is detected.

ACUTE INFLAMMATION OF THE BLADDER, OR ACUTE CYSTITIS.

Symptoms.—When inflammation has extended to the bladder, the gonorrhœal discharge ceases, the desire to make water is incessant, the irritation of the mucous coat causes a sensation of fulness, even when the bladder is empty, and gives rise to constant painful straining to effect its evacuation. The pain is most intense when the bladder is distended, and in that respect the pain caused by cystitis differs from that produced by calculus. The urine deposits a sediment of a mucous, purulent, or muco-purulent character. Pain, chiefly in the region of the bladder, but extending towards the perineum and scrotum, fulness and tenderness in the hypogastric region, sediment in the urine, and irritative fever are the characteristic symptoms. In young persons, cystitis is chiefly met with as a consequence of gonorrhœa, and at after periods, as an aggravation of chronic cystitis, resulting from stricture, diseased prostate, calculus, or the use of instruments. The symptoms usually change into those of chronic cystitis, but they sometimes assume an ataxic character, and end fatally.

Treatment.—This consists of perfect rest in the recumbent posture, free depletion by means of leeches applied to the hypogastric region, the occasional administration of gentle laxatives, a dose of calomel at the beginning, followed by a little castor oil, hot baths, and warm fomentations, barley-water, the citrate or nitrate of potass largely diluted, antimonials, and the thorough influence of opiates, so as to subdue the pain. The opiates are best given in the form of enemata, and require to be frequently repeated. Should the inflammation depend upon a metastasis of the gonorrhœa, it will most probably cease on the return of the urethral discharge, which should, therefore, be promoted by warm emollient fomentations and the hip-bath.

CHRONIC INFLAMMATION OF THE BLADDER, OR CATARRHUS VESICÆ.

Constant desire to pass water, caused by irritation of the mucous membrane, constitutes at first the principal symptom of this affection. After it has existed for some time, the urine becomes loaded with a greyish, ropy, tenacious mucus, sometimes tinged with blood, giving a highly alkaline reaction, and forming a glairy deposit on cooling, often nearly equal in quantity to the urine itself, which is much darker than natural, and emits an offensive ammoniacal odour. Urinary deposits, especially phosphates, are often mixed with the sediment. This chronic state of inflammation is rarely a primary disease, being generally a consequence of calculus, stricture, enlarged prostate, or disease of the rectum. Not unfrequently this disease proves fatal, the principal symptoms for some little time before death being a dry, brown tongue, an extremely feeble pulse, oppression of the brain, and the usual symptoms of urinary poisoning of the blood.

Epithelium, mucus, and pus, so frequently found in diseased states of the urinary organs, are so well described by Druit, that I cannot do better than give the following quotation :—

"*Epithelium,* from any part of the urinary organs, may be present in urine. Here we may recall to the recollection of our readers, that under slighter degrees of irritation the uniting medium which gives consistence to any epithelial or cuticular layer becomes loosened, the epithelium is formed in greater abundance, and is shed or *desquamated* more rapidly than natural. Under higher degrees of irritation or inflammation, the entire epithelial covering is stripped off or *excoriated*—a state of things usually followed by the evolution of pus globules on the inflamed surface. 1. The small round gland epithelium from the kidney, and the nuclei of disintegrated epithelium cells, are often found in small quantity in the urine when containing oxalate of lime, or when irritating from any other cause. 2. The kidney epithelium may be agglutinated by fibrinous effusion, and may be found in the sediment of albuminous urine in the form of *epithelial casts,* in those acute and chronic inflammations which Dr. G. Johnson calls *desquamative nephritis.* 3. The same epithelial cells and casts also may be found loaded with oil globules in certain stages of some varieties of Bright's disease. 4. The *epithelium from the pelvis, ureters,* and especially from the *bladder,* is often found in great abundance when these parts are irritated by the urine, or by any other cause. The writer has found immense quantities in the urine after difficult labours; it presents itself as a purulent-looking deposit, seen under the microscope to consist of columnar or oval cells, of very various shapes and sizes, with single nuclei, the larger and older cells often full of granular matter, and almost disintegrated. The urine is not albuminous of necessity.

"*Mucus,* a viscid, stringy, structureless substance, coagulated by acetic acid; alkaline in its reaction, when proceeding from the bladder and fauces; acid, when coming from the vagina; not albuminous; often containing large quantities of phosphate of lime, and having the property of rendering the urine alkaline, and of precipitating triple phosphate. It usually contains some amount of desquamated epithelium, and a few globules, perhaps epithelial nuclei in a granular state.

"*Pus* may be present in the urine, through suppuration of any part of the mucous lining of the urinary passages, or from an abscess in some contiguous part which has burst into them. It generally falls to the bottom of the vessel containing the urine, 'forming a dense homogeneous layer of a pale-greenish cream colour, seldom hanging in ropes in the fluid, like mucus, and becoming, by agitation, completely diffused through it. The addition of acetic acid neither prevents this diffusion, nor dissolves the deposit. If a portion of the deposited pus be agitated with an equal quantity of liquor potassæ, it forms a dense, translucent, gelatinous mass. On decanting some urine from the deposited pus, the presence of albumen may be detected by heat and nitric acid.' The pus globules may be recognised under the microscope, and the addition of acetic acid reveals the characteristic nuclei. 1. When pus comes from the *uriniferous tubes*, the kidney being in a confirmed state of suppurative disorganization, it may sometimes be found moulded in the form of the tubules; but at all events it may be presumed to come from this source, if constantly present in the urine, and equably diffused through it, and if there are the other signs of kidney disease to be presently described. 2. Pus from the bladder will probably be mixed with large quantities of mucus, constituting muco-purulent matter. 3. Pus from an abscess will be variable in quantity, and not equally diffused. We must here remark that a few pus globules are often mixed with epithelial debris without the urine being albuminous."

Treatment.—The exciting cause must be removed or modified before a cure can be effected. Rest in the recumbent posture should be prescribed, with the pelvis raised, and opium administered as an enema, to relieve pain, together with gentle laxatives. Local bleeding, unless the inflammation runs very high, seems only to aggravate the symptoms by reducing the patient's strength; and mercurials are, for the most part, worse than useless. Counter-irritation on the hypogastric region in general affords relief. When the inflammation is subdued, buchu, *uva ursi*, and *pareira brava* are often useful, with the addition of the mineral acids, if a disposition to deposit phosphates exist. Copaiba, cubebs, and the muriated tincture of iron have often a beneficial effect when given in small doses, and when the inflammation has greatly abated. As the cure progresses, it has sometimes been found advantageous to use simple injections of tepid water, slightly acidulated by the addition of ten drops of the diluted nitric acid to two ounces of warm water. If, however, pain or irritation be excited by their use, they must be at once discontinued. The beneficial effects of this proceeding, especially when the urine is fœtid and loaded with mucus and phosphates, are very great. The best means for washing out the bladder is a double catheter with a syringe adapted to one of the orifices. Rest, the recumbent posture, with the pelvis raised, opiate enemata, counter-irritation on the hypogastrium by means of the nitrate of silver, pareira with the mineral acids, the regulation of the bowels by small doses of castor oil, and a regimen rather generous than otherwise, are the remedies most generally useful.

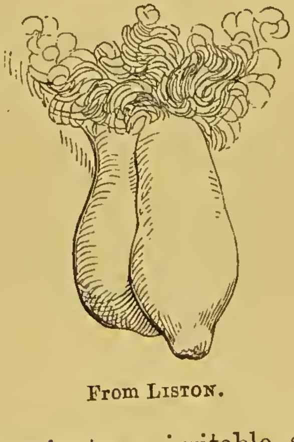
WARTS.

Preputial gonorrhœa frequently gives rise to warts, the position of which may be any part of the surface of the glans and prepuce. They vary much in size and number, being sometimes few and small, sometimes large and covering the whole of the parts. If few and small, they soon disappear under the repeated application of the sulphate of copper; but if large, the preferable proceeding is removal by scissors, followed by occasional application of the sulphate of copper.

PHYMOSIS AND PARAPHYMOSIS.

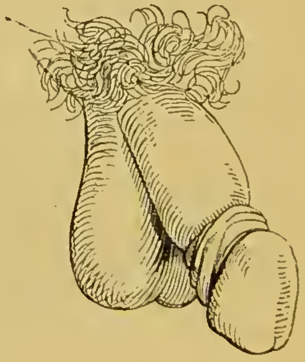
In most instances the prepuce can be easily retracted over the glans even during erection; in some cases, however, this is impracticable, and such a stage is termed phymosis. It may be either *congenital* or *accidental*. In the latter case it is often produced by inflammation, and consequent swelling of the prepuce from an attack of gonorrhœa, by the cicatrization of ulcers, the presence of warts, &c. When the phymosis exists only in a slight degree, no great inconvenience is felt, nor is any special treatment requisite; but when it occurs to a greater extent, the matter secreted collects beneath the prepuce, giving rise to considerable irritation, and to a discharge resembling gleet, which often excites ulceration. If the orifice is very much contracted, much pain and suffering are experienced in passing water. If inflammation arise, the prepuce becomes enormously distended, and by its mechanical pressure frequently causes great pain. When inflammation occurs, the most active antiphlogistic remedies must be adopted. Fomentations and poultices must be applied, and suspension of the part resorted to, together with antiphlogistic treatment; and should the inflammation still continue unchecked, or retention of urine take place, or should the phymosis depend on warts, on obstinate or irritable sores, or on an ulcerated condition of the surfaces of the prepuce and glans, the prepuce must be slit up by an operation. This is effected by inserting a director by the side of the frænum, introducing a sharp-pointed bistoury upon it, transfixing the prepuce and slitting it up, one or two small sutures being then passed through the edges of the wound to prevent the separation of the internal and external integuments. The unseemly appearance of the flaps is soon and almost entirely removed by interstitial absorption. If the phymosis depend upon too great length of the prepuce, which not unfrequently happens, especially when it is *congenital*, this may be drawn forwards from the extremity of the glans, and a portion

Fig. 231.



From LISTON.

Fig. 232.



From LISTON.

of it removed by a circular incision, the same precaution being afterwards taken to secure the adhesion of the integuments and lining membranes by slight sutures.

An opposite condition of the prepuce often exists, where, having been drawn back over the glans, it is incapable of being returned. This is called paraphymosis. The cause of this is in almost every instance a partial phymosis. When it assumes this condition, it acts as a tight ligature, constricting the urethra, and impeding the return of the blood from the glans, which in consequence becomes œdematous and inflamed, and unless the strangulation is quickly relieved, gangrene ensues. When the constriction is only slight, it will yield to the local application of cold and a manipulation of the same nature as the taxis : but if this fail, the constriction must be divided ; and this is best effected by depressing the penis, separating the swellings behind and before the constriction, and with a sharp-pointed curved bistoury dividing the stricture. The symptoms will be at once relieved, although it may not be practicable to return the prepuce immediately after the operation.

Besides the local sequences of gonorrhœa already referred to, and others which will afterwards be described, gonorrhœa has the power of impressing certain individuals with constitutional affections, in this respect having a resemblance to syphilis, although the affections are of a different character from those produced by syphilis, and much more unusual in their occurrence. These chiefly are certain affections of the skin, of a roseolar or papular character, or resembling pityriasis ; affections of the mucous membrane of the throat ; inflammations of the testicle ; gonorrhœal rheumatism, and gonorrhœal sclerotitis. This form of gonorrhœal ophthalmia must not be confounded with gonorrhœal conjunctivitis, as the one disease has its chief seat in the sclerotic coat and the other in the conjunctiva, and the one is a constitutional effect of gonorrhœa, and the other—namely, gonorrhœal conjunctivitis—a consequence of the application of gonorrhœal matter to the eye.

SYPHILIS.

This term is used to denote various morbid appearances, which are arranged into two grand divisions—namely, the *local* or *primary*, and the *constitutional* symptoms of the disease ;—the former consisting of certain ulcerations, commonly termed chancres, and consequent upon them, of swellings of glands, technically called buboes ; the latter, which are subdivided into the secondary and tertiary symptoms, consisting of various morbid affections of the skin, mucous membrane, periosteum, bone, and other textures.

LOCAL OR PRIMARY SYMPTOMS.

It must not be supposed that all sores on the penis are venereal ;

for that organ is, like other parts of the body, liable to irritation and inflammation ; and common excoriation and ulcers may form on it as elsewhere. Neither must we conclude that all sores consequent on sexual intercourse are syphilitic, as excoriations may be produced by sexual intercourse, which originate in irritation, or in the contact of acrid secretions, not venereal or connected with the inoculation of syphilitic virus. Simple excoriations and common sores are distinguished by their history and appearance, and by the absence of the peculiar characters of the various forms of venereal ulcers. Venereal ulcers do not form immediately on the application of venereal poison ; a certain interval elapses, varying in duration according to the manner in which the virus is applied. When the surface to which it is applied is entire, ulcer rarely appears for five or six days, and often the interval is longer ; but when it is applied to a broken surface, the appearances come on much more rapidly, the wound becomes painful, and in many instances decided symptoms of syphilitic ulcer are perceptible in twenty-four hours. There are several kinds of venereal ulcers, which, though they all originate in a common cause, namely, the application of venereal virus, yet differ materially from each other both in the character of the primary sores, and in the subsequent constitutional symptoms. As the technical term, chancre, is, strictly speaking, applicable only to those ulcers which have a corroded appearance, many prefer the expressions primary sores, or primary ulcers. Primary venereal sores are of various kinds ; but those which are most remarkable, and so clearly defined by their distinctive characters as to present no difficulty of discrimination, are the four following :—

I. *The Simple Venereal Ulcer.*—This—called by some writers the common venereal ulcer, and by others the elevated ulcer—is found more frequently on the internal surface of the prepuce, and in the sulcus behind the corona glandis, than in any other situations. It is also often met with on the glans, and usually there are more sores than one. When the sore results from the application of the virus to an entire surface, the first symptoms are itching and redness, followed by vesication, and the pustule gives way and discharges its contents either by the bursting of the cuticle, or by a portion of the scab becoming detached, and thus exposing the ulcer underneath. Such are the changes in the first or inflammatory stage. The form of the ulcer is usually circular, or nearly so ; its surface concave ; its colour pale, surrounded by a bright inflammatory areola ; the discharge rather ichorish ; and the pain considerable. Such are the appearances during the second stage, when the virus contained in the matter is most calculated to propagate the disease. In the next stage, the surface of the sore, instead of being depressed, becomes covered over with granulations, which are pale and flabby, and rise like a small fungus above the surrounding parts ; the ring of inflammation also becomes indistinct. This is the third stage, or that of reparation or granulation, and is succeeded by cicatrization. By these distinctive characters, and by the absence of any surrounding induration, phagedæna, or elevation of the edges, the diagnosis is easily made out. When the sore arises from the application of the virus to an abraded surface, the part very soon becomes painful, a scab forms, and in the subsequent progress the appearances are as already described.

Treatment.—It is extremely desirable to arrest the progress of the disease as speedily as possible, since there is every reason to believe, that if the removal of the local disease be accomplished very early by the entire destruction of the part affected, a perfect protection is in the great majority of instances ensured against constitutional symptoms. That the chance of securing this protection diminishes as the destruction is deferred, there can be no doubt; but if it be effected within the first two or three days from the commencement of the specific or inflammatory process, or perhaps at any time until near the period of the bursting of the matrix vesicle, while the disease is local, the constitution may be preserved untainted. It is now well known that the virus is contained in the discharge secreted during the second stage, and that this is consequently the period which is most favourable for the employment of the test of inoculation, and in which the constitution is particularly apt to be affected, or the disease to be communicated by sexual intercourse.

A principal object, therefore, of the surgeon will be, to prevent the occurrence of that stage; or, to cut it short, if it be too late to prevent: in either case, his plan will be to convert the sore into a simple ulcer by the entire destruction of the affected part; or, in other words, to institute the ectrotic treatment. Of the various means adopted for this end, that most generally employed is the application of the solid nitrate of silver, which should be applied so efficiently as to ensure the complete destruction of the affected part. This is done in the first stage, not only with the view of stopping the disease, but also of affording a protection against constitutional sequelæ; in the second stage, only with the hope of cutting short the disease. This is the mode of destruction which I have generally preferred; and for after dressings, I have in many cases applied nothing but a piece of dry lint, and on the falling off of the scab have found the sore healed: in other instances I have used watery dressings, or black wash. Such is the treatment in the second stage; in the third, the immediate object aimed at is, to repress the elevation of the granulations; and that can be very conveniently done by occasionally pencilling them very lightly with nitrate of silver, or sulphate of copper, and in the intervals, applying to the part either simple watery dressings, or the solution of the sulphate of zinc, as the appearances may indicate.

II. *Ulcer with Elevated Edges.*—The situations in which this sore is most frequently found are on the prepuce, both on its internal and external surfaces, in the fossa behind the corona glandis, and on the corona glandis itself. It is also very frequently found at the margin of the prepuce, where it is apt to occasion phymosis. Its formation may take place very speedily after sexual intercourse, if the virus has been applied to an abraded surface, or not till after some days, if the surface has been entire. The distinguishing peculiarities of this ulcer are, that the margin is elevated above the sore and the surrounding surface, and also slightly indurated ; the surface is excavated and of a brownish raw colour, and of irritable appearance without commencing granulations. The discharge is thin, the pain is considerable, and in some instances the destruction by ulceration is somewhat rapid. Among the negative marks of distinction are the absence of phagedæna, and of induration of the base, or the surrounding parts. It is usual to find more than one sore at the same time. The treatment is the same as for the simple venereal sore.

III. *The Hunterian*, or *True Chancre.*—The ordinary sites of this ulcer are the glans penis, the frænum, the fossa behind the corona glandis, and the body of the penis. The first is the most frequent. The formation of this sore has been known to take place in one day, but in some instances, not for some weeks ; it is usually found, however, about the third or fourth day, or from that to the seventh, after sexual intercourse. Its distinguishing peculiarities are, that after a pustule containing matter, an ulcer results, the form of which is circular, or approaching to circular ; the edges either regular or very slightly indented ; the surface much excavated without the appearance of granulations, and covered with a viscid ash-coloured substance ; and the base hard, with this peculiarity, that the hardness is usually defined and terminates abruptly, instead of gradually blending with the surrounding parts. The progress of the ulcer is slow, indolence of action being a distinguishing peculiarity. By these peculiarities, together with the negative signs, namely, the absence of phagedæna, and of a surrounding areola of inflammation, the diagnosis is easily made out. This ulcer, unlike the former, is in most instances solitary.

The treatment of this chancre is the same with that of the two former, except that a much more extensive destruction, by means of nitrate of silver, is necessary in order to ensure the entire removal of all the parts affected with hardening, and the formation of a simple healthy ulcer on the separation of the eschar. Lint dipped in water, in the solution of the sulphate of zinc, or in the black wash, may be applied in the ordinary dressings, as the appearance of the ulcer may indicate. To the use of mercury in the treatment of the primary sores we shall refer in a future page.

IV. *Phagedænic Sore.*—The three varieties, namely, phagedæna, or phagedænic sore, sloughing or gangrenous, and sloughing phagedæna, called by some writers the phagedæna gangrenosa, are so similar to each other in the circumstances in which they are found, in their symptoms and in their treatment, that it will be more convenient to describe them together than to assign a separate section to each. The term phagedæna, derived from *φάγω, to eat*, is well applied to this kind of ulcer, as there is the appearance of regular eating away, or destruction by phagedænic ulceration, without any attempt at granulation. This kind of destruction, though most commonly seen as a form of syphilis, is by no means confined to syphilitic disease.

Phagedæna, or a phagedænic ulcer, may be distinguished by the following peculiarities :—The edges are extremely irregular and of a dark-purplish appearance, a red colour extending a considerable way into the surrounding parts ; they are exceedingly painful, and at parts inverted ; the surface of the sore is uneven, and extends underneath the edges ; it is of a livid or dark-red colour, and, together with the edges, has a very irritable appearance. It is covered by a thin ichorish bloodly discharge. The sore enlarges with alarming rapidity, and the destructive process may continue to be carried on either by ulceration alone, or, which is more common, by ulceration together with sloughing, so as to constitute the variety called by some writers the sloughing phagedæna, and by others the phagedæna gangrenosa. In the other variety, namely, the sloughing sore, the destruction is by sloughing alone ; the sore enlarges by the formation of one slough after another, and the surface of the sore on the separation of the slough, instead of presenting the appearance of granulations, has a raw, red, irritable appearance. These three varieties exhibit the same appearance of edges, and occur in similar circumstances ; they differ chiefly in the appearance of the surface of the sore, there being in the phagedænic sore an irregular appearance of the surface, occasioned by the ulcerative process ; in the sloughing phagedæna the same appearance at some parts, and a wet, ash-coloured slough at others ; and in the sloughing variety a wet slough covering the sore. The character of each of these ulcers is so peculiar, that there can be no difficulty in distinguishing them from each other, or from any of the syphilitic ulcers formerly described. A high degree of constitutional disturbance attends each of these three varieties. The tongue is white, the skin dry, the pulse quick and small, with loss of appetite, prostration of strength, and the other symptoms of high irritative fever ; which, when the disease is extensive and of long continuance, is apt to assume the typhoid type, and that sometimes quickly. Individuals whose constitutions have been rendered irritable by intemperance, by want of proper food or regular rest, by living in damp or confined situations, or by leading irregular lives, are those in whom phagedænic ulceration is most apt to take place, and in whom it is likely to proceed to the most alarming results. On this subject Professor Samuel Cooper says:—"The causes of phagedænic ulceration may frequently be traced to the condition of the individual's health; to his having neglected to restrict himself to proper regimen; to his having been guilty of excess; or to his having neglected some other kind of primary sore at its commencement."

Treatment.—Of all methods of treatment of these three varieties of ulcers, I prefer for local treatment the energetic destruction of the whole of the ulcer by means of an escharotic, followed up with the use of a soothing poultice, and afterwards of water-dressings, either simple or medicated; and for constitutional treatment, the adoption of proper hygienic arrangements, regulation of the stomach and bowels, generous digestible diet, attention to the state of the skin, the use of wine, and, above all, of opium, given several times a day, so as to keep the system decidedly under its influence.

The above statements, it is hoped, will be sufficient to point out clearly the distinctive characters, and the treatment of the principal forms of primary venereal sores.

The Consecutive or Constitutional Symptoms of Syphilis are divided into two grand classes—the secondary and tertiary; the former comprehending certain eruptions on the skin, affections of the mucous membrane, and iritis; the latter, affections of bone, periosteum, certain tubercular affections, assuming in many cases the characters of rupia prominens, and ending in irritable sores, affections of the mucous membrane, and iritis.

SECONDARY AFFECTIONS.

The principal eruptions are the papular, the pustular, the scaly, and the tubercular.

I. *The Papular Eruption.*—The papular eruption, or venereal lichen, as it has been designated, is preceded by fever, which is attended with pains in the head, shoulders, knees, and larger joints, and sometimes in the chest, where a feeling of anxiety is at times experienced. The pains are most severe at night, and the febrile symptoms, which are at their height before the appearance of the eruption, do not cease when the eruption comes out, but continue as long as successive crops appear. The eruption is of the papular form, the part being at first of a red colour, varying in brightness in different cases; by and by, however, there is the appearance of pustules with elevated tops, containing lymph or matter; and afterwards, when the eruption is on the decline, it presents in the desquamating stage a scaly appearance from exfoliation of the cuticle; the colour being in this stage much paler, and having a copper tinge. The time of the appearance of the eruption after the primary symptoms is very variable. In many examples the eruption is found all over the body, but is usually most copious on the face, chest, back, and belly; and frequently, after having entirely subsided, it returns at very uncertain intervals, though each successive attack is in general less extensive, and accompanied with less febrile derangement. Passive inflammation of the conjunctiva is very frequently an accompaniment of this eruption; and it is almost invariably attended with inflammation of the mucous membrane of the throat, the back of the pharynx, the tonsils, and the fauces, which for the most part are red and swollen, and present a raw appearance, and are often covered with an aphthous coating. There is difficulty of deglutition, and at times the glands of the neck become swollen. It is of the greatest practical importance not to confound the desquamating stage of the papular eruption with the scaly eruption to be presently described.

The exhibition of mercury forms no part of the proper treatment of this affection, experience showing that, when taken *before* the appearance of the eruption, it increases the fever and local pains, and when *after* its appearance, it seems to be followed by increase of the local pains, and recurrence of eruption. It is only after the desquamating stage is over, that its exhibition can be ventured upon with any advantage, and, indeed, without being injurious; and even then it is not essential, or even useful, except when given in small alterative doses, and combined with some antimonial, or with sarsaparilla. The treatment which is recommended by many authorities, and which I have found very satisfactory, consists in the strict adherence to the antiphlogistic regimen, until all febrile symptoms have completely subsided; in purging the bowels very smartly at the commencement, and afterwards keeping them in an open state by cooling aperient medicines; in producing determination to the skin by saline, antimonial, and other suitable diaphoretic medicines, so as to promote the coming out of the eruption; in preserving the surface of the body warm; in enjoining confinement to the house while painful symptoms continue; in the occasional use of the warm bath, the use of nutritious, but light and digestible food; and, after the subsidence of the eruption and of all febrile symptoms, the employment of a course of sarsaparilla and iodide of potassium, with all judicious means for restoring the strength and improving the general health.

II. *The Pustular Eruption.*—In this, as in the former case, the appearance of the eruption is preceded by febrile symptoms, with local pains. In some persons successive crops, and also the co-existence of pustules in different stages are observable. The matter which forms dries into a thick scab, below which a superficial ulcer is concealed, the mildness of which, and the absence of any tendency to spread, distinguish it from the tubercular eruption. On the healing of the ulcer and the separation of the scab, the cicatrix has a discoloured appearance. The same treatment is found useful as in the papular eruption.

III. *The Scaly Eruption.*—The scaly eruption, as was noticed by Hunter, is sometimes preceded by efflorescence of the whole body, and presents, as Dr. Willan remarked, a mottled-red appearance of the skin, similar to that of roseola annulata; this, however, in a short time passes away, and leaves the skin covered with scurfs or scales. The scaly eruption usually exhibits the appearance either of syphilitic lepra or of syphilitic psoriasis. In syphilitic lepra the spots on the skin are of a circular form, of a reddish, or what is called a coppery colour; they are a little elevated above the surrounding surface, and the circumference of each spot is rather more elevated than its centre. The patches are in general distinct and at a distance from each other; they are of a bright colour, and the cuticle over them desquamates, giving to the spot a scaly appearance. The eruption is usually most copious upon the forehead, back of the neck, trunk, and groin. In syphilitic psoriasis the spots, instead of being circular and large, are small, irregular, and less elevated. The appearance caused by this eruption varies in different parts of the body; for example—when parts are affected which are naturally in contact, as when it is between the nates or under the arms, the skin, instead of presenting a scaly appearance, becomes elevated and moist, is destitute of scales, and is covered with a whitish secretion; when it attacks the palms of the hands, or the soles of the feet, instead of forming scales, the whole cuticle is thrown off, and is followed by the formation of another cuticle, which is thrown off in the same manner. The affection of the throat which accompanies the scaly eruption is peculiar; the tonsils are the part usually affected, and, to use the language of Hunter, there is "a fair loss of substance, part being dug out, as it were, from the body of the tonsil with undermined edges. This is commonly very foul, having thick white matter adhering to it, like a slough which cannot be washed away."

With regard to the treatment of the scaly eruption, most surgeons of great experience agree, that mercury is the most valuable remedy, when judiciously given, in moderate doses, and only to such an extent as will not produce derangement of the general health, or excite much, if any, salivation. The rule I have observed in the use of this medicine is, to discontinue it as soon as the eruption disappears, or the gums become in the slightest degree affected. The effects of mercury in the scaly and papular eruptions are very different indeed: and hence arises the importance already mentioned of not mistaking for the former the desquamating stage of the latter. It is always necessary, however, to remember that mercury in this as well as in other states, must be administered with judgment and discretion. If there be much accompanying pain, or an irritable state of constitution, or much derangement of the general health, the employment of mercury will be not only not useful, but positively injurious. The proper treatment for such states should, in the first instance, be instituted; and when the symptoms unfavourable to the use of mercury have been removed, it may then be tried, and in many instances the happiest effects will result. Of the three modes of administering mercury, namely, of friction, fumigation, and internal administration, I prefer the last. The best mode of employing fumigation is that propose by Mr. Henry Lee, which consists in evaporating calomel and water by means of a lamp and an apparatus for confining the vapour.

IV. *Tubercular Eruption.*—This form of eruption is usually preceded by languor, debility, severe nocturnal pains, and derangement of the general health. Tubercles, but little raised above the surrounding surface, make their appearance; they are very painful and irritable; the skin becomes red, and after its ulceration a crust forms, the removal of which exposes a foul and very irritable ulcer, with inflamed irregular edges, and with no disposition to take on a healthy action. In many instances, these ulcers after some time exhibit a peculiar appearance, in consequence of a healing process taking place in the centre, while the ulcer extends at its circumference by phagedænic edges. The joints, and especially the knees and ankles, are often exceedingly painful, the pain increasing at night, and in many cases they are actually inflamed. The affection of the mucous membrane, which accompanies this eruption, is of a most formidable character. Beginning generally on the pharynx or velum palati, where an aphthous sore presents itself, it rapidly spreads along the mucous membrane of the throat and nose, and is extremely apt to give rise to destruction of the hard and soft palate, as well as to extensive caries, and destruction of the spongy, ethmoid, and other bones, with the usual train of distressing consequences resulting from that destruction. This eruption is, even under the most favourable circumstances, of a formidable character; but when it takes place in individuals of a scrofulous diathesis, and when the system has been rendered irritable by intemperance or by the injudicious use of mercury, its consequences are usually painful in the extreme.

Treatment.—During a considerable number of years, I have had an extensive experience of the various modes of treatment in the female syphilis ward of the Aberdeen Royal Infirmary, and my experience there and elsewhere is, that no treatment with which I am acquainted is so beneficial in this form of secondary syphilis as that which I have described as being so in syphilitic phagedænic ulcer.

CONDYLOMATA.

Condylomata, or mucous tubercles, differ from primary warts, in being produced by a constitutional condition, and not by irritating discharges, or want of cleanliness. For the treatment of condylomata nothing more satisfactory could be desired than the gentle internal administration of mercury, to a very slight extent, and the constant application of the black lotion. It is surprising how quickly these excrescences disappear.

The Tertiary Affections, consisting of certain tubercular formations, having many of the characters of rupia prominens, and often degenerating into foul and irritable ulcers; affections of the periosteum; of the bones, often ending in ulceration, or caries, or necrosis, or nodes, or enostosis, a most formidable affection of the mucous membrane of the throat and nostrils, giving rise to very distressing results, and iritis, seldom occur until a long period after the cessation of the primary symptoms, and rarely until after the secondary symptoms have either disappeared entirely or ceased for a very considerable time. The treatment of these affections must be conducted according to the general principles formerly laid down.

The three following subjects are deserving of much fuller discussion than my limits will permit:—1. Inoculation, and other modes of communicating syphilis. 2. The use of mercury in the treatment of syphilis. 3. Syphilization.

Inoculation.—The results of inoculation have been attended to by many observers, and by none more carefully than by M. Ricord of Paris. The results of his experiments are, that the pus of primary syphilitic sores, in their ulcerative and progressive stages, produces the characteristic pustule, whilst that of secondary and tertiary syphilis produces nothing, any more than that of chancres in the period of reparation. In other words, primary syphilis is communicable by inoculation, but secondary and tertiary are *not*. The results of M. Ricord's experiments are confirmed by those of Dr. Mairion, who made experiments in not fewer than two hundred and fifty-seven cases in the Military Hospital at Louvain; and not only in the results of inoculation, but also as to their being communicable from one person to another, the primary, secondary, and tertiary forms of syphilis present remarkable differences. Primary syphilis is communicable by inoculation and by contagion; the latter in the intercourse of the sexes, being the most common means of propagating the disease—the thin condition of the epidermis, the moisture and friction, all rendering absorption easy. Sometimes the disease has been communicated to the fingers of medical men by inoculation, while making the necessary examinations per vaginam in labours. Secondary syphilis, although not communicable by inoculation, is by inheritance; and also, beyond all doubt, from mother to child, from husband to wife, and from nurse to child, the virus being communicated through the medium of tainted secretion. The mouth of the infant, for instance, infects the nurse, or the breast of the nurse the mouth of the infant; and in such cases there is often considerable difficulty in determining whether the disease has passed from nurse to child, or from child to nurse. "These *alternative* affections are only too frequent;—hence arises a question: Is there any means of determining whether the disease has passed from the nurse to the child, or from the child to the nurse? If the disease exist in both individuals at the same time, and has arrived at the stage of consecutive disease, one can only form a probable opinion from the state of health of the father and mother, the child, and husband of the nurse, and from the time at which the disease showed itself in one or other of them, which it is sometimes very difficult to ascertain. But one may be certain that the child has communicated the disease to the nurse, if it has ulcers in the fossæ nasales, tubercular pustules in a scaly or ulcerated state in any part of the body, with marks of a disease already of long standing. On the other hand, we may be certain that the nurse has infected the child if she has ulcers at the anus, pustules on the body, or exostoses, and the child simply ulcerations of the mouth, nose, or anus."

On the use of Mercury.—The indiscriminate use, and the indiscriminate withholding of mercury in the treatment of syphilis, are both practices which are now generally allowed to be extremely injudicious; and which, fortunately for mankind, are in a great measure abandoned. That much mischief has been done by the profuse and indiscriminate exhibition of mercury; that primary, secondary, and tertiary symptoms have often been aggravated, and frightful mutilations often been induced by the improper and excessive use of this medicine, and that such severities and mutilations are much less common since a milder and more prudent practice has prevailed, are propositions regarding the truth of which there is no reasonable ground of doubt. But the opinion maintained by some writers who are unfavourable to the use of mercury, that to this medicine, and not to syphilis, are to be ascribed many affections of the skin, nose, throat, iris, periosteum, and bones—in short, the conditions which are usually regarded as the secondary and tertiary forms of syphilis—is clearly incorrect, inasmuch as these affections may occur, and often have occurred, in syphilitic patients who have not taken any mercury; whereas in no instances where mercury is given in other diseases do we find it produce eruptions and other affections like those of syphilis; in no instances do we find it produce iritis, disease of the nose or of the bones. In short, these affections may be produced by syphilis without mercury, but they do not result from mercury without syphilis. Ever since syphilis broke out in this country, mercury has more than any other medicine obtained the general confidence of the profession, notwithstanding much random and injudicious practice in its exhibition, from a notion which at one time prevailed, that it is not only a specific for syphilis, but that the disease could not be cured without it; and notwithstanding, also, the many substitutes for it which have been at various times proposed, such as sarsaparilla, guaiacum, nitric, nitro-muriatic acids, and other medicines. Mr. Rose, while surgeon to one of the Regiments of Guards, instituted the treatment of syphilis without mercury, in the numerous cases which came under his care in the Regimental Hospital; and he there found that the primary sores got well without mercury, and that the secondary symptoms generally exhibited nearly the same characters as usual, and were, as well as the primary symptoms, removed without mercury in every instance, a few cases of iritis excepted; and from these results Mr. Rose concluded, that syphilis is curable without mercury. Many army surgeons adopted the same views, followed the same practice, and found the same results. The strong constitutions of the soldiers, the strict regulation of their diet, and freedom from exposure to cold and damp while under treatment, were all favourable for enabling them to throw off the poison of syphilis, and are supposed by some surgeons to furnish an explanation of the successful results of this treatment in the cases mentioned. Mr. Rose found that the same treatment was not successful in private practice, and in consequence, he returned at length to the usual mode of treatment, and prescribed mercury. The opinion, therefore, which experience seems to justify is, that as yet we are not acquainted with any remedy of equal efficacy with mercury for extirpating the poison of syphilis. It is not, however, as has been already stated, to be used in every case, but with due discrimination; and when prescribed, it ought to be with moderation, and on no account further than slightly to affect the gums.

In cases of primary sores, if the ectrotic treatment has been successfully employed, there is no poison in the system to extinguish, and therefore mercury is not given. When the ectrotic treatment has not been tried, or has not been successful, mercury is given in the three first forms of primary sore, but *especially in the third.* Some limit its use to the third and to obstinate cases of the second, not allowing it at all in the first, in which it certainly does not seem so essential. For my own part, I have prescribed mercury only for those cases of the first variety of primary sore which proved obstinate after the use of other remedies. In the phagedænic sore, the use of mercury would aggravate the symptoms, and it ought therefore not to be prescribed. In some cases of secondary and tertiary symptoms, it is both advisable and necessary; in cases of papular eruption, as has been already stated, it is almost always injurious, except as a mild alterative after the subsidence of the eruption. In the pustular eruption it may be given, if the treatment previously recommended has not had the desired effect, and the disease persists or returns; in the scaly eruption, and especially after the Hunterian chancre, it is indispensable, and of the greatest advantage; in tertiary affections of the skin, which have not yielded to other treatment, in periostitic affections of tertiary occurrence, and in all cases of iritis, it ought to be prescribed. These are the principal cases in which mercury is advisable. The conditions in which its use is undesirable are, an inflamed phagedænic or sloughing condition of sores, whether primary or consecutive; febrile excitement; the syphilitic affections succeeding on the phagedænic form of primary sore; the scrofulous diathesis; and a weak and irritable condition of constitution.

Syphilization.—This term is used to signify the cure of syphilis by inoculation with the virus of chancre. In 1844, M. Auzias Turenne, while trying to transfer syphilis from man to the monkey, discovered that, after repeated inoculations, the parts of the animal became insensible of being affected by the virus. This was the first step in this somewhat singular subject of investigation; and to this condition, resulting from repeated inoculation, he gave the appellation, Syphilization. M. Auzias Turenne took up the idea that continued inoculation might be advantageously applied to the human body for the cure of syphilis, and instituted a series of experiments with that view; but before their results were published, M. Sperino of Turin, having been made acquainted with the experiments of M. Auzias Turenne, also adopted the idea of using a continued inoculation with the virus, in order to cure syphilis; and published a memoir in 1851, giving an account of numerous experiments, to show that constitutional symptoms may be cured by repeated inoculation. For some time this opinion was considered absurd, or looked upon as mere fancy; but it soon engaged the attention of other able observers, and especially of Dr. Boeck, Professor of Medicine in the University of Norway, whose labours, and those of others in the Scandinavian kingdom, proved beyond doubt that the state named by M. Auzias Turenne Syphilization may be induced in man, and that by it syphilis may be cured. The very extraordinary idea was entertained by some, that inoculation might be used as a prophylactic method. But this notion was soon abandoned; and Professor Boeck, and most others who have practised inoculation, now hold the belief that it is justifiable, and should only be resorted to on the appearance of constitutional syphilis. They also believe that when secondary syphilis does appear, the earlier it is employed the better; that the desired result will be sooner obtained, if employed early; that it is much more difficult to procure immunity in patients who have taken mercury; and that relapses are more apt to take place in those who have taken that medicine. The Scandinavian authorities believe that syphilization *can* be used for curing constitutional syphilis, and that it *ought* to be used. This last-mentioned belief is grounded on the opinion that it is not only successful, but that it does less harm to the constitution than mercury, and other means which they think, instead of being regarded as remedies, should be looked upon as pernicious and dreaded agents.

The parts selected for inoculation are the trunk and the inside of the thighs and arms. The virus employed for inoculation may be taken from any form of chancre. The pustules form in a few days, and with the matter of these pustules repeated inoculations must be performed until no results follow, when inoculation must again be employed with virus from a primary sore, and the same course pursued until inoculation ceases to produce pustules. The use of fresh virus is resorted to a considerable number of times, and ought to be so when the matter of the pustules ceases to produce any effect, and persevered with until no result follows inoculation with virus from a primary sore. The constitutional symptoms begin to improve in general in five or six weeks, but it may be ten or twelve months before they cease entirely, and appear to be eradicated. My limits will not permit me to give a fuller account of the experience of Boeck, and of the conclusions at which he has arrived, or to state the experience of Malmsten, Danielssen, and others, who have practised inoculation with syphilitic virus, not only for the cure of constitutional syphilis, but also to determine its effects in curing other diseases. So far as I am aware, the tediousness, the irksomeness, the filthy and disgusting nature of this proposed mode of cure, along with other serious considerations, have hitherto prevented its adoption by all authorities in these islands, in America, and, with few exceptions, on the Continent.

PERMANENT STRICTURE.

Exciting causes.—Repeated gonorrhœas and long-continued gleets are the most frequent exciting causes of stricture; but it may arise from any source of urethral irritation, such as mechanical injury, the use of injections of too stimulating a character, calculus in the bladder, the presence of lithic acid or of phosphatic deposit in the urine, intemperance, or contraction consequent on ulceration of the urethra, however such ulceration may have been induced.

Seat of Stricture.—Stricture may occur at any situation anterior to the prostatic division of the urethra; but its most frequent sites are at the bulb, at the natural bend of the penis when pendulous, in the membranous portion of the urethra, an inch behind the orifice, and at the orifice itself, constituting what is called orificial stricture. The two first-mentioned sites are the most common. In 77 out of 98 examples of stricture, referred to by Mr. H. Smith, the constriction was found in the bulb or in some part between it and the orifice; and in 21, in the membranous division of the urethra. For making clear the most frequent sites of stricture, Mr. H. Thompson divides the sites of stricture into three regions, and gives the proportion of 270 strictures in each. The first region comprises three-quarters of an inch behind, and one inch in front, of the junction of membranous and bulbous portions; the second region consisting of the two and a half anterior inches of the urethra; and the third region comprising the space between the first and the second. Of 270 strictures, 215 were situated in the first, 54 in the second, and 51 in the third region. The prostate division of the urethra may be said to have complete immunity from stricture. An example of stricture in this division is not contained in any museum in Paris, London, or Edinburgh.

Symptoms.—The urine is observed to pass in a gradually diminishing stream, which at length becomes twisted or forked. A few drops are left in the urethra, after all the urine seems to have been expelled. There is, especially after exposure to cold and damp, a sense of scalding and irritation along some part of the urethra during micturition, the calls to which are very frequent. These symptoms belong to what has been called the first stage. In the second, the bladder becomes very irritable, and the urine on cooling deposits a flaky mucus. Matter resembling that of gleet is discharged from the urethra, mingled sometimes with blood or pus, indicating the presence of an ulcer or abscess. If the stricture be of long standing, the induration of the part constricted may be felt externally. By the introduction of an instrument, the existence of stricture is put beyond all doubt. Besides these local symptoms, there are often rigors, tenesmus, hæmorrhoids, pains in the loins, chronic enlargement of the testicle, herpetic eruption on the glans and prepuce, shooting pains in the perineum, and, in severe cases, complete retention with extravasation of urine, or abscess and fistula in perineo. The great and constant irritation preys upon the constitution, and low hectic fever comes on, the countenance assuming a pallid copperish hue.

State of the parts.—Permanent stricture may be the result of a low degree of chronic inflammation, in consequence of which lymph is effused to a greater or less extent beneath the mucous membrane of the urethra, the calibre of which is thus diminished; and this lymph, after the lapse of some time, becomes indurated. Or, as Hancock has so clearly shown, lymph is sometimes effused upon the free surface, becomes developed into imperfect fibrinous tissue, and thus diminishes the size of the canal. Or, it may depend upon the formation either of a membranous septum stretching across the urethra and pierced by a small aperture, or of a simple band stretching from side to side. In this last case it is termed a *bridle stricture.* In a case of old stricture, the mucous membrane behind the contracted part may become inflamed and ulcerated; and this condition may extend to the cellular tissue, and an abscess may be formed, bursting in the perineum, and eventually constituting fistula in perineo; or, in consequence of the great dilatation of the urethra behind the stricture, that canal itself may burst, and the urine become extravasated into the perineum. The prostate may become enlarged, and the bladder hypertrophied; chronic cystites, or first functional derangement, and afterwards organic disease of the kidneys, may ensue; or distension of the ureters and of the pelves of the kidneys may take place.

Treatment.—Some of the various methods of treatment are the following:—

1. *By the Bougie.*—A bougie is selected of such size as is likely to pass without much difficulty. Having been dipped in warm water and oiled, it is to be passed down, and, on arriving at the stricture, to be steadily but very gently pressed onward, with the view of penetrating the stricture. This having been accomplished, it should be allowed to remain for a few minutes, unless the patient complain of pain, in which case it must be at once withdrawn. In the use of the instrument, lightness of grasp and the greatest gentleness of pressure are requisite; for to press forcibly or to grasp tightly would occasion the risk of either pressing the stricture before the instrument, or of perforating part of the urethra. If unsuccessful with the bougie first employed, others should be passed down to the stricture in a series of gradually decreasing sizes, until one is inserted into the bladder. When the stricture has been penetrated, the instrument remains fixed after the hand is withdrawn. If, therefore, the instrument resiles, it is an evidence that penetration has not been effected. The first introduction of the bougie is in some instances attended with severe pain, faintness, and rigors; but these unpleasant symptoms are usually felt less at every succeeding operation. There is usually, also, after the first operation, ardor urinæ in some degree, together with considerable pain for some time at the stretched parts, and increased difficulty of passing water. The uneasiness and irritation caused by the operation generally subside in the course of two or three days. The operation should then be repeated, with a gradually increasing size of instrument; and this proceeding should be resumed at intervals until the normal size of the urethra be attained, and the largest bougie can be introduced without any difficulty; after which a large one should be occasionally used at increasingly long intervals, until it be ascertained that there is no tendency to a return of the constriction. The cure is thus accomplished on the principle of dilatation, the effect of which in the first instance is mechanical, but ultimately it causes removal of the stricture by interstitial absorption. This mode of treatment is applicable to the great majority of strictures, and wherever applicable, it ought to be preferred to every other method, as being the best, the simplest, and the safest.

2. *By the Silver Catheter.*—If, however, a stricture be very difficult to dilate,—or if there be an irregular condition of the urethra from long continuance of the disease,—or a false passage,—or great difficulty in effecting penetration,—or severe rigor following each introduction of the instrument,—or retention or a threatening of retention of urine,—the proper treatment is, to introduce a silver catheter through the stricture, and retain it by tapes. The orifice of the catheter is kept closed, but opened from time to time for the evacuation of the urine. The pressure of the catheter gives rise to a certain degree of irritation

and swelling, in consequence of which it becomes by and by very firmly constricted. The irritation produces a slight grade of inflammation, and a considerable discharge of matter usually ensues, followed by widening, relaxation, and absorption, by which means the desired result is in most instances very speedily obtained. The instrument having become perfectly loose is withdrawn in three days, and a larger one, or a flexible catheter, introduced for twenty-four hours, after which the dilatation is perfected by the bougie. In the class of cases mentioned above, this proceeding is highly satisfactory; and, judging from my own experience, a better or more successful mode of treatment could not be desired. It must be admitted, however, that it is attended with greater inconvenience and risk than the treatment by the bougie, and should therefore be restricted to cases in which the latter is unsuitable. It is seldom necessary to allow the instruments to remain above four or five days; and in some cases, their use must be limited to a much shorter period. Some surgeons use the flexible catheter, but the silver one is more easily guided and less irritating, and I therefore always prefer it. Sir Benjamin Brodie recommends the use of a gum catheter, mounted on a strong unyielding iron stilette, with a flat iron handle like that of a sound or staff. He says: "Being so mounted, it is more readily directed into the bladder than when mounted in the usual way on a thin flexible wire. When the gum catheter has entered the bladder, withdraw the stilet and leave the catheter with a wooden peg in its orifice, which the patient is to take out whenever he has occasion to void his urine, it being at the same time secured by a suitable bandage. After three or four days you may withdraw the catheter for twelve hours; or if much suppuration is induced in the urethra, you may withdraw it for a longer period; then introduce a larger catheter than the first, and thus you may, in the course of ten days or a fortnight, dilate a very contracted urethra to its full diameter." In both these methods of proceeding, namely, by the bougie and by the catheter, the principle of treatment is to induce absorption, the existing cause of which is mechanical dilatation.

3. *By Perineal Section.*—Professor Syme has recommended an excellent proceeding for the treatment of certain strictures, namely, free division of the stricture by external incision upon a small, grooved, slightly curved staff, passed through the stricture. This new operation is now known by the appellation of "perineal section;" but was originally described under that of "division of stricture by external incision." The performance of this easy operation is facilitated by the staff lately constructed by direction of Mr. Syme. The vesical extremity is small, that it may readily pass through the stricture into the bladder, and the remaining portion is as large as a No. 8 catheter, and the change of diameter is abrupt, so that the thick portion, sloping in front of the stricture, may indicate where the division should terminate ante-

riorly. The patient having been put under the influence of chloroform and placed in the attitude for lithotomy, the grooved staff is passed through the stricture into the bladder and entrusted to an assistant. The surgeon makes a free incision about an inch and a half long in the mesial line, and divides the textures external to the urethra over the situation of the stricture. A small straight bistoury is then sent into the groove of the director behind the stricture, and by bringing it forward the whole of the contracted part is divided. A No. 7 silver catheter is introduced through the urethra, and retained for at least 48 hours, when it is removed and cleaned, and again inserted. The patient should remain quiet upon his back, with a pillow under his knees; and important precautions to be attended to are,—not to allow the wound in the urethra to heal by the first intention, as that mode of union would expose the patient to a relapse of the disease; to prevent the edges of the integument from uniting in the first instance, lest the patient should be exposed to the dangers attending incisions made from the interior of the canal; to make sure that the stricture is completely divided; to guard against laying open the urethra so far back as to divide the deep fascia of the perineum, the division of which would increase to a great degree the danger of extravasation of urine. The extreme rarity of strictures behind the bulb fortunately renders division unnecessary so far back as to endanger the deep fascia. Another important precaution is, to introduce instruments occasionally during recovery, and occasionally afterwards, to prevent recontraction. Neglect of some of these precautions has no doubt led some to characterize this operation as both dangerous and useless. Syme has published the result of his proceedings, which have been very satisfactory; and he states that the advantages of this mode of treatment are, that it is speedy, safe, and effectual. He considers it the best that could be applied, where the stricture is very obstinate and contractile. All surgeons of experience are aware that some strictures of long standing have the physical characters of non-dilatability and contractibility to a remarkable degree. In some cases, a stricture is so unyielding, that instruments, however skilfully and perseveringly employed, do not materially enlarge its calibre; and some have contractibility to such an extent, that whatever temporary dilatation may have been effected, they, even under the observance of the most favourable hygienic conditions, return very speedily to their original calibre. For such strictures perineal section is a most satisfactory proceeding. There are four classes of cases, however, for which Syme's operation of urethrotomy is peculiarly useful :—1. Non-dilatable; 2. Contractile; 3. Strictures attended with fistula in the perineum or scrotum, with much plastic exudation; 4. Tight strictures, with great sensibility of urethra. As a general rule regarding strictures, I hold most firmly the belief of Mr. Liston when he said, "Whenever a catheter can be got through a stricture, its cure by dilatation is in the surgeon's hands." Yet I am equally convinced that in the classes of cases mentioned above, division by external incision on a grooved staff is the speediest, the best, and most successful treatment with which we are at present acquainted. During the time that this operation has been upon its trial, it has been condemned, as appears to me, very harshly and unfairly by some who have said that it is not new, that it is dangerous, and that the cure is not permanent. Although an entirely different operation, which will afterwards be described, has been long known, in which the stricture is divided by external incision, yet any one who makes himself perfectly acquainted with the history of surgical operations cannot but come to the conviction, that this is a new proceeding in practical surgery. That a few deaths have happened after this operation, and chiefly from pyæmia, is perfectly certain; but those who urge this objection should remember the evils that result from bad strictures when not cured; that this operation is suggested only for cases incurable by other means; and that if a fatal result in an exceedingly small proportion of cases is to be considered sufficient to render an operation unwarrantable, we must on the same principle consider almost every operation in surgery unwarrantable. There would be force in this objection if the operation were proposed for strictures curable by other means. That the cure has not been permanent in every case there can be no doubt; but while patients live without the observance of proper hygienic conditions, or continue to contract gonorrhœas, or live intemperately, or neglect the judicious precaution of occasionally introducing a bougie, stricture will be apt to return after every method of cure. For the adoption of this method of treatment it is essential that the stricture be not impassable; but Syme contends that, according to his experience no strictures are impassable, and remarks:—"So long back as 1844, I expressed my persuasion that no stricture was truly impermeable, the exit of water being a certain sign that instruments might, through sufficient care, be introduced. This principle of practice was obviously of great importance, since conviction of its truth would obviously lead to much more prolonged and careful exploration of the passage than would be thought requisite, if belief in the impermeability of stricture was entertained. For my own part it was frankly confessed, that, while sharing in the doctrine of impervious urethras, I had occasionally found them so, and performed the old operation, while ever since adopting the principle that every stricture might be permeated by instruments through time and care, I had not, either in public or private practice, met with one that proved incorrigibly obstinate."

Mr. Henry Thompson most completely expressed my sentiments on this interesting point when he wrote:—"I do not hesitate to endorse the proposition, that where the urine issues by the external meatus, an instrument may, with time and patience, care and gentle manipulation, be passed through the stricture into the bladder; the crisis of retention of urine sometimes excepted, when time is not always present, nor are circumstances favourable. I do not affirm the impossibility of exception, but I am entitled to say, after a considerable experience, and with the full consciousness of the responsibility of so doing, that such exceptions should be very, very rare indeed."

4. *By Urethra Dilators.*—The object aimed at is to accelerate the cure by effecting actual dilatation to a greater degree than can be accomplished by the gentle pressure of the bougie. Some of the many urethra dilators are Mr. T. Wakley's, Holt's improvement of M. Perrève's instrument, Coxeter's dilator, Buchannan's compound circular catheter, and Sheppard's instrument. Mr. Wakley's instruments are ingenious, and, in some cases, most valuable. I have used them frequently with the greatest advantage in a certain class of cases, and consider them an important addition to the instruments for the cure of stricture; an opinion, I think, that must be entertained by all who have used them carefully in cases for which they are suitable. They consist of a very small catheter, which is passed through the stricture into the bladder, of a slender steel rod, which is secured into the catheter, so as to make with it a directing-rod, and of a series of silver and also of elastic tubes, graduated from a size a little larger than the directing-rod, to that of a No. 10 bougie. The tubes are made to glide through the stricture upon the directing-rod; and the stricture may, by that means, be dilated to any extent the surgeon may consider judicious. Another great advantage of this apparatus is, that one of the elastic tubes can be sent into the bladder upon the directing-rod, which may then be withdrawn through the tube, leaving the latter in the bladder; by means of which the cure is conducted on the principle of the treatment by the catheter, but with the great advantage that much time is saved by a moderately large tube being lodged at once in the stricture. The action of these instruments will be perceived in a moment by any one who has an opportunity of examining them; and the employment of them in suitable cases will produce a strong impression in their favour. Holt's instrument consists of a staff formed of two blades, joined at the vesical extremity, and capable of being separated from each other by means of dilating tubes sent between the blades upon a conducting-rod, the extent of separation being regulated by a screw. With this instrument forcible dilatation can be readily effected; but it cannot, like Wakley's, be used on the principle of the catheter. I have several times used this pretty apparatus with advantage, and consider it a great improvement on Perrève's instrument, which I have seen in several of the medical schools on the Continent. Coxeter's dilator consists, also, of two plates, joined at their smaller extremity, and

capable of being separated from each other by bars, riveted at each end, whose action is directed by a nut and a screw, and resembles that of the parallel ruler. Although I have been in the habit of showing Coxeter's dilator, and also the compound circular catheter of Buchannan, and the instrument of Sheppard, consisting of a small grooved catheter, with a button called a traveller, capable of being moved by means of a wire, I have no experience of their use in the living body.

5. *Division within the Urethra* may be effected by Stafford's lanceted stilette, Fergusson's urethrotome, or the instrument of Civiale. I have no experience of this method, and I refer the reader to a very clear and interesting paper by Mr. H. Thompson, on the value of internal incision; against which, I confess, I have always entertained a strong prejudice. He lays down three rules, which, on account of the danger of hemorrhage, extravasation of urine, and pyæmia, he regards as essential for successful practice:—1st. The cutting instrument must be passed through the stricture, and the incision made from behind forwards. Civiale's instrument is constructed to admit of that mode of division. 2nd. The contracted part must be divided in its entire length. 3rd. The borders of the incision should be maintained apart by catheterism, subsequently performed, and healing by first intention should thus be prevented.

6. *By Potassa Fusa.*—Those who resort to cauterization as a therapeutic agent in the treatment of stricture, prefer the potassa fusa to the nitrate of silver, as the latter gives rise to the adhesive form of inflammation. Mr. Whately was the first to recommend the use of potassa fusa, but he restricted its employment to cases of permeable stricture. Mr. Wade has extended its employment; and in his hands it has been used with great success in three classes of cases: 1. Strictures having a cartilaginous hardness, impermeable as well as permeable. 2. Strictures apt to bleed on the introduction of the bougie. 3. Irritable strictures. A bit of the caustic about the size of a pin's head having been fixed into a hole made in the end of a soft bougie, and covered with lard, is sent down, and pressed against the stricture for a minute or two, if impermeable, and moved backwards and forwards through the stricture two or three times over the whole surface, if permeable. In cases of impermeable stricture, the bougie usually passes through after two or three applications. Instead of the soft bougie, the tubes, or portes-caustiques, are used for the application of the potassa fusa.

7. *External division for impermeable Stricture.*—This operation, known also by the names of the old operation, *la boutonnière*, or button-hole operation, must not be confounded with "perineal section," proposed by Syme. The mode of external division, called "perineal section," is for permeable stricture, and the division is made on a grooved director, lodged in the bladder; whereas this mode of external division is for impermeable stricture, and the parts are

divided against the end of a No. 8 catheter, passed down to the front of the stricture. The patient having been brought under the influence of chloroform, and placed in the position as if for lithotomy, and a No. 8 silver catheter having been passed down to the front of the stricture, the surgeon, sitting in front of the patient, sends a bistoury through the raphè of the perineum backwards towards the apex of the prostate, with its back towards the rectum, with the view of opening the dilated urethra behind the stricture, and then cuts forward on the point of the catheter, in the hope of dividing the stricture, and being able to send back the catheter into the bladder. This operation is now, fortunately, very rarely required, as since the introduction of chloroform, almost every stricture, by time, patience, and skilful proceeding, is found permeable, except in the cases of retention of urine; and, indeed, this seems to be the only condition that warrants its performance. It is most fortunate that it is so seldom necessary, as it is said, in certain states, when fistula and a hard and gristly condition of tissues exist, to be one of the most difficult operations in surgery, and that some good surgeons have failed to find the posterior part of the urethra.

SPASMODIC STRICTURE.

The phenomena of spasmodic stricture are now perfectly intelligible; and those who denied the possibility of that form of stricture on the ground of no muscular fibres having been discovered in sufficiently close proximity to the mucous membrane to affect the calibre of the canal, can no longer rest on that ground of objection, since organic muscular fibres, of whose existence Hunter entertained a belief, have been demonstrated by Kölliker, and since minutely investigated and described by Jabez Hogg and Hancock. The writings of Kölliker, Hogg, and Hancock on this subject are extremely interesting, and highly deserving of perusal. Hogg and Hancock have shown that the urethra is surrounded by two layers of organic or unstriped muscular fibres, continuous behind with the coats of the bladder, proceeding forward; they embrace the substance of the prostate, the inner layer surrounding the mucous lining of the prostatic portion of the urethra, the external passing over the prostate gland, they meet in front of the prostate, and joining together, form the muscular covering of the membranous covering of the urethra; they then separate again to embrace the corpus spongiosum, the inner continuing everywhere joined to the mucous membrane by cellular tissue, the outer embracing the corpus spongiosum, placed between it and its fibrous covering, and in front they meet together to form the lips of the external meatus. The urethra is thus surrounded everywhere by two layers of organic or unstriped muscular fibres, the inner everywhere in contact with the mucous membrane, and joined to it by fine cellular tissue, the outer in contact with the inner at two parts—the external meatus and the membranous portion of the urethra, and separated at two, namely, where they embrace the prostate gland and the corpus spongiosum urethræ. The muscularity of the urethra and the existence of spasmodic stricture are questions now set at rest. The calibre of the urethra may be said to be susceptible of being diminished by congestion of its mucous membrane or its erectile tissue, by spasm of its involuntary or unstriped muscular fibres, or by spasm of voluntary muscles, such as the muscles of Wilson and Guthrie, the levator ani and accelerator urinus.

Causes and Symptoms.—Habitual or frequent excesses in drinking, venereal indulgences, an irritable condition of urethra caused by repeated attacks of gonorrhœa, luxurious living, and all conditions capable of rendering the system irritable, are some of the many predisposing causes; while exposure to cold and wet, by which the action of the skin is diminished, indulgence in spirituous or acid liquors which render the urine unusually irritating, piles, irritation of the stomach or bowels, and rheumatism or gout, or any condition causing the urine to be loaded with lithates, are exciting causes. The symptoms are—desire to pass water, with either complete retention, or a slight quantity passing off during absence of severe spasm, great straining, the desire to pass water coming on in fits, sense of weight and uneasiness in the perineum, distension of the bladder, and, if relief be not obtained, the giving way of the urethra and extravasation of urine.

Treatment.—The warm bath, or, when that cannot be obtained, a warm hip-bath, covering up the patient in bed, a powerful enema of laudanum in a little starch, a full dose of Dover's powder at night, or what in many cases is better, calomel for once at night combined with a decided dose of opium and a mild aperient in the morning, have almost always the desired effect. Attention to the general health, proper hygienic regulations, attention to the state of the skin, bowels, and condition of urine, are all important for preventing a return.

CONGESTIVE STRICTURE.

This condition, when it takes place, is usually the result of continued urethritis, or of some condition which renders the urine unusually irritating or much loaded with lithates. It is most frequently a consequence of irritating injections, or of exposure to cold or intemperance during a gonorrhœal attack. Its most frequent sites are the membranous and prostatic divisions of the urethra. It is attended with pain in the perineum, tenderness on pressure, with the usual symptoms of spasmodic stricture, and often with irritative fever. The treatment is the same as for spasmodic stricture, with the addition in many cases of leeching, antimonials, and other antiphlogistics. The warm and hip-bath are very useful, and ten or twelve drops of the muriated tincture of iron given every ten minutes have often been prescribed with apparent advantage.

RETENTION OF URINE.

The principal conditions which give rise to retention of urine, together with the appropriate treatment, now come to be considered.

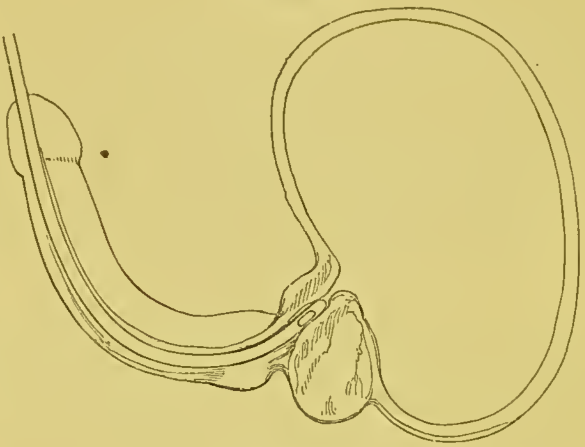
1. *Retention from Stricture of Urethra.*—Should a case of retention present itself, caused by a hard and gristly stricture situated in front of the scrotum, and should it be found impossible to penetrate the stricture by the usual gentle manipulation, in which the instrument is held lightly and pressed against the stricture without any force, the surgeon should take hold of the hard part between the forefinger and thumb of the left hand, and pass down the catheter to the stricture, and gently and cautiously effect penetration, and lodge it in the bladder. Should the stricture which causes retention be situated behind the scrotum, and should it be found impracticable to pass the catheter by the most cautious, gentle, and dexterous manipulation, the proper practice is to perform the old operation of sending back a catheter to the stricture, cutting into the dilated portion of the urethra behind the stricture, when the urine will escape, and dividing the stricture by cutting forward upon the point of the catheter, and sending it back so as to lodge it in the bladder. Liston truly said that the operation of introducing a catheter, through what has been called an impermeable stricture, is without doubt the most difficult in the whole range of surgical operations, and demands all the prudence, science, and skill of a master. The art can only be acquired, and that gradually, by frequent practice. Such are the most advisable proceedings when retention is caused by stricture.

2. *Retention from Abscess in the Perineum.* — Occlusion of the urethra with consequent retention of urine is occasionally produced by abscess in the perineum. The proper practice in such circumstances is free direct incision, so as to evacuate the matter and remove the cause of obstruction.

3. *Retention from Enlargement of Prostate Gland.*—Enlargement of the prostate gland is not unfrequently a cause of retention. A portion of the gland rising up at the commencement of the urethra acts as an obstacle to the passage of the urine. This cause of retention can in general be readily overcome by attending to the following precautions:—Using a very long catheter, with a large curve, and the point more than usually bent—and depressing the handle to a much greater degree than in performing catheterism in ordinary circumstances.

The accompanying woodcut will show the importance of these directions. The unusual length of the catheter is necessary on account of the rising up of the bladder, and consequent elongation of the urethra. The peculiarity of form and the depressing of the handle admit of the instrument being sent up in front of the obstruction, instead of pressing against the obstruction, as would be the case in using an

Fig. 233.



From Liston.

ordinary catheter in the usual way. Should all efforts to introduce the instrument prove unavailing, the least hazardous proceeding is, to perforate the obstruction, in doing which the greatest care must be taken, that the point of the instrument be lodged in the prostatic portion of the urethra, and that it be sent in the proper direction into the bladder. Brodie, Liston, and most surgeons of great experience, recommend this proceeding of forcible catheterism in preference to puncturing the bladder, and in that recommendation I most cordially concur. The instrument should be allowed to remain for three days, after which it is usually found to enter with sufficient readiness on being re-introduced. Puncturing the bladder from the rectum, which can be safely done for the relief of retention when the prostate gland is not diseased, is in hypertrophy of that body rendered inadmissible, by the anatomical relations of the parts in their altered state, unless the disease be confined to the urethral portion of the prostate. It cannot be effected without either penetrating the gland with the chance of not reaching the bladder, or running the risk of wounding the duplicature of peritoneum, which lies in close contact with its posterior border when in a state of hypertrophy. When the prostate is of its normal size, the bladder can be easily punctured from the rectum without injuring important parts. The breech of the patient having been brought over the edge of the bed, and his limbs supported by assistants as in the operation of lithotomy, the canula of a curved trocar is guided by the finger to the triangular space, bounded by the vesiculæ and the peritoneum, the stilette is then made to protrude, and the whole instrument pushed forward into the posterior fundus of the organ, the trocar is withdrawn, and the canula retained until the cause for the operation is removed. With regard to puncturing above the pubes, the risk of infiltration is so great, that it ought not to be attempted, except under the most extreme circumstances, and as a last resource. I have never yet needed to perform this operation; it has not been resorted to at the Aberdeen Hospital by my colleagues or myself during our connexion with that institution, and I have only once seen it performed in private practice. The operation consists in dividing the skin in the mesial line, immediately above the pubes, and in passing a long curved trocar with its convexity downwards into the bladder, underneath the deflection of peritoneum. The trocar is then withdrawn, and the canula retained by a suitable bandage, until the obstacle necessitating the operation has been overcome, and the continuity of the natural passage restored.

4. *Retention from Paralysis.*—The detrusor urinæ may become paralytic in consequence of over-distension, injury or disease of the spine, or the feebleness of age. In addition to the treatment suitable to the state which has caused the paralysis, the urine must be drawn off twice in the four-and-twenty hours, to prevent discomfort and allow the weakened parts a chance of regaining tone.

URINARY ABSCESS AND EXTRAVASATION OF URINE.

There are two forms of these affections—the vesical and the urethral; and each may occur in one of two ways—from without or from within. 1. An abscess may form in the cellular tissue, close to the bladder or urethra, and in its progress of enlargement may open into the bladder or urethra, and thereby admit an entrance of urine into the purulent cyst. A fresh accession of the inflammatory process is set up by the stimulus of the urine, and the progress may be more or less rapid; but in general it is much more so than that of an ordinary acute abscess, and speedily ends in the formation of a dark-coloured and exceedingly fœtid collection. If the urine and pus remain limited within the suppurated space, there is then constituted what is properly called urinary abscess; but if the pyogenic membrane give way, the urine becomes infiltrated into the surrounding tissues, constituting the condition called extravasation of urine, which speedily ends in destruction of the affected parts. 2. These affections may originate within from ulceration, or bursting of the bladder or urethra. The urethral form is the more common, and the most frequent sites of abscesses are—1. The perineum between the bulb of the urethra and the anus. 2. The inferior portion of the scrotum. 3. The scrotum itself. 4. The under surface of the body of the penis. By far the most frequent exciting cause is the giving way, during a violent effort at micturition, of a dilated and attenuated portion of the urethra behind an old organic structure. During a violent effort to pass water the patient distinctly feels that something has given way; he experiences relief, finds in some cases that he can pass a little water owing to the stricture becoming a little relaxed from diminution of the pressure; is often pleased, and calls himself better; but so far from being better, the most rapid and extensive gangrenous destruction of parts, with black tongue, clammy skin, flickering pulse, hiccup, muttering delirium, and other symptoms of low typhoid depression, speedily cause death, if proper measures are not instantly and decidedly adopted for relief.

Treatment.—It is simple, but must be early and decided. It consists in early, free, dependent, external incision for the evacuation of putrid pus and urine, in relieving the bladder by passing a catheter, in preventing farther extravasation by retaining the catheter in the bladder, in supporting the patient by wine, brandy, opium, ammonia, and nourishment, and in treating the sloughing parts as the common principles of surgery suggest. The bladder or urethra may also be ruptured by external violence, as by a fall or a blow, or by a portion of bone in fractures of the pelvis. The chief points of treatment consist in introducing a full-sized catheter into the bladder, retaining it for some time, and incising the parts, if infiltration has taken place.

URINARY FISTULA.

Urinary fistulæ present great varieties in length, size, direction, number, and situation. They may be long or short, small, admitting only a probe, or large cloacæ, straight or tortuous, single or multiple. Civiale in one case met with 52 fistulæ; and in a patient I some years ago treated successfully in the Aberdeen Hospital, the scrotum was everywhere perforated by fistulæ, through which the whole of the urine had been discharged for months. Those, however, of the greatest importance to be observed, are classed in reference to situation; for although the treatment must vary according to their size, yet for practical purposes it is necessary to arrange them into three distinct divisions—perineal, scrotal, and penile.

Treatment.—If the fistula be caused by stricture, the first object to be aimed at, whatever be the situation of the fistula, is the cure of the stricture. The treatment for the accomplishment of this object having already been explained, I shall only observe here that it is of great consequence for the surgeon to arrive at a correct judgment as to whether treatment by the bougie, by the catheter, or by perineal section, be the most judicious proceeding. There can be no doubt, in my opinion, that in many cases perineal section should be preferred; but I am perfectly satisfied, judging from my own experience both in public and in private practice, that, in the majority of cases, results as satisfactory as need be desired will be obtained from treatment by the catheter, until the urethra is dilated to a moderate size, and afterwards by occasionally passing a bougie. While the catheter is being employed, it is of importance to select one of a full size for the state of the urethra. If too small, a portion of the urine will pass out by the side of the instrument; and if too large, it will be apt to stretch the aperture of communication between the urethra and fistula. In many instances, the fistulæ heal up without any treatment whatever, when the urethra is restored to its normal size; but, in others, after the cause has been removed, the fistula remains, and requires to be made the subject of special treatment. If the fistula be perineal and of small size, the occasional passing into it of a wire, made red-hot, or of a probe coated with melted nitrate of silver, or a wire made hot by the galvanic current, will be found to effect a cure; but if the fistula be large and attended with loss of substance, the preferable practice is to pass a catheter, to vivify the edges, and to retain them in apposition. A means formerly used for the last-mentioned purpose was the quilled suture; but the apparatus lately devised by Dr. Battey of Georgia, U.S., for vesico-vaginal fistula, will be found to answer the purpose most admirably, and to be infinitely superior, and deserving of being preferred. This apparatus will be explained when we describe this operation; but meanwhile it may be stated, that the principle carried out is direct pressure upon approximated edges. If the fistula be scrotal, it is often necessary to lay it open, and cause it to granulate from the bottom. Penile fistulæ of considerable size, until a recent period, were considered as amongst the opprobria of our art, and were abandoned as beyond its power; but, fortunately, they are now rendered amenable to surgical treatment. It is important to have distinct ideas of the causes of difficulty. These are principally—1. The coverings of the urethra, being thin, do not possess sufficient substance to furnish an amount of granulation adequate to close any but a very small aperture. 2. The thinness renders it difficult to obtain from the surrounding parts a flap sufficiently thick to preserve its vitality after transplantation. Owing to involuntary and uncontrollable erections and other causes, the parts cannot be kept in that perfect steadiness of position so essential for union, and the want of which will render it impossible for the most skilfully planned operation to succeed. To Dieffenbach we are indebted for much interesting information as to the success of various methods of urethroplasty, as well as other important departments of plastic surgery. His first operation in this department consisted in converting the opening into a lozenge-shaped one, reversing the edges, bringing them together by means of twisted sutures, and removing tension by distant lateral incisions. His next operation consisted in dissecting beneath the skin from his "outlying lines of incision" inwards towards the fistula, so as to detach the skin between the lateral incisions from the subjacent parts, and to convert them into what he terms a "bridge." This has been called Dieffenbach's method by lateral bridges and twisted sutures. One object in view, besides taking off tension, was to allow the urine, that might for a time escape from the urethra, to pass out at the posterior part of either lateral incision, so as not to interrupt the adhesion of the bridges to each other. Nelaton modified this method of Dieffenbach by making the incisions above and below instead of lateral, and afterwards devised a modification of Dieffenbach's operation, which, I believe, is the most successful proceeding we are yet acquainted with for penile fistula, above any but the most inconsiderable size. It consists in lodging a catheter in the bladder, reviving the edges of the opening by paring, in dissecting up the skin subcutaneously to the extent of an inch through an opening below the fistula, in bringing the edges together by a few points of suture. Erichsen has practised this operation with success, and suggests that the procedure may sometimes be advantageously modified "by paring the edges of the fistula, making lateral incisions, and then passing across but underneath the flap a strip of India-rubber, to prevent contact of the urine disturbing the adhesions." In Mr. H. Thompson's instructive papers on the treatment of urinary fistulæ, much interesting information will be found which cannot fail to be highly useful in this department of plastic surgery.

URINARY FISTULÆ IN THE FEMALE.

The urinary fistulæ to which the female is liable derive their names from the organs with which they communicate. The principal varieties are—vesico-vaginal, urethro-vaginal, vesico-uterine, vesico-utero-vaginal, and vesico-rectal. These affections may be caused by abscess, phagedænic ulceration, sloughing, gangrene resulting from contusion inflicted by the unskilful use of instruments, but by far the most frequent cause is laceration or bruising during parturition by the pressure of the child's head in cases where the bladder has not been preserved empty during labour. My limits will not permit me to give an account of the opinions of different authorities as to the comparative frequency of the different forms of this affection, or to describe the principal varieties as to shape and size. I shall only remark, in regard to size, that they vary from the smallest fissure to an opening sufficient to admit a pretty large orange. In some cases the wall of the urethra, the vesical trigone, and bas-fond have been found destroyed. The most extensive destruction I have ever had an opportunity of seeing was an exceedingly bad case, in which Dr. Beatty of Dublin operated with admirable dexterity in 1859, in one of the Dublin hospitals. The destruction was so extensive that I saw the urine passing out of the ureters into the bladder; and it is the only instance in which I ever saw the extremities of these canals in the living body.

The situation of a female, the escape of whose urine is constant, is truly deplorable, and deserving of the deepest commiseration. The soiling of her clothes, the chafing of the parts by the constant dribbling of urine, their unfitness for the performance of their appropriate functions, the odour which no amount of cleanliness can prevent, render her situation most trying to herself, unfit her for society, and oblige her to live in constant retirement. Such being some of the distressing results of a condition until lately regarded as beyond the aid of surgery, too much praise cannot be given to the distinguished men who by their skill and dexterity have proved that these deplorable maladies in their most aggravated form are amenable to an operation whose satisfactory and gratifying results constitute one of the greatest triumphs of modern surgery. To Dr. Sims of New York the greatest merit belongs, for he no doubt led the way, and devised and executed a successful operation, which, in some important points, has been improved by Dr. Bozeman of Alabama, and Dr. Battey of Georgia, U.S., and is now practised by many surgeons with great success.

Sims' operation consists in placing the patient on the end of a couch or narrow table, with the limbs dependent, and the trunk lower than the nates, in exposing the parts by the duck-bill speculum, in thoroughly denuding, or, as the French term it, vivifying, the edges, passing silver wire sutures through the edges, the ends of which are, after introduction, passed through holes in two metal bars which are sent down to the sides of the fissure, and made to act as quill sutures, by split shot being sent down, and made to bite the wires by being pinched with a forceps, after the wires have been drawn and the plates so placed as to secure perfect approximation of the edges of the fissure. Dr. Bozeman improved this operation by the introduction of the button suture, consisting of an oval piece of lead perforated by foramina, through which the ends of the fine silver wire are drawn and secured by leaden crotchets made to bite the wire by being compressed by a forceps. The button suture gives support and steadiness to the edges of the closed wound, and is considered a decided improvement. The operation of Dr. Battey involves the new principle of direct pressure upon the approximated edges of the fistula, and the apparatus for carrying it out involves "both the compress and the splint."

Dr. Battey's combined compress and splint is made of sheet lead of such thickness as to be easily adapted to the vaginal curve, and to retain the form given to it. It is perforated with small holes towards one edge, and notched on the other, and cut of sufficient length for covering the wound when the edges are brought together. Dr. Battey also uses a wooden spatula, which is of great service in bringing the edges of the wound together. The edges are pared in the usual way, and fine silver sutures introduced parallel to each other in the usual way. As the wires are introduced, they are passed through the holes in the splint, secured by perforated shot, leaving fully an inch of free end. The wires having been introduced and fixed in the splint, the operator makes traction upon the wires, and by that means draws down the posterior lip of the fistula. He then places the wooden spatula underneath the wires, and by holding them and pressing the spatula upwards, perfect command is obtained over the anterior flap, and the edges of the wound can be approximated most perfectly to each other. The holding of the ends of the wires and of the spatula is then confided to an assistant. The operator then takes hold of a single suture beginning at one side, and by means of a slender bit of wood or the handle of a scalpel with a small notch in its extremity, presses it into one of the notches of the splint, twists it round the small end left beyond the perforated shot, clamps them together, makes a secure twist suture, and then cuts off the ends. The remaining sutures are secured in the same manner. The advantages of this apparatus and mode of proceeding are—1. "The compress upon the approximated edges condenses the tissues, and, forming a water-tight joint, effectually prevents the leakage of urine, while no danger of strangulation is incurred; hence ensures the cure. 2. The compress directly hastens adhesive union, by bringing the surfaces with more certainty into firm and even contact. 3. The opportunity afforded of viewing the parts up to the point of final and satisfactory closure, is as complete as could be desired. 4. The power of the apparatus for bringing down the vagina, and for closing the opening, when there is great loss of substance and rigidity of tissues; and this with less danger of wires cutting out. 5. The splint keeps the parts at rest, prevents the urine being drawn through between the sutures by capillary force, and offers a smooth, even surface upon which the cicatrix is to be formed." I have, with great admiration, seen Dr. Battey operating, and I am aware that his success in perfectly curing cases of extensive destruction of tissue has been very great.

Dr. Simpson uses a hollow needle for inserting the sutures, and a circle made of wires plaited together for preserving the whole site of the wound steady. After the operation, a metallic catheter curved like S joined to an elastic urinal should be retained in the bladder, the patient should be placed on her side, inclined towards her face, she should be kept constantly under the decided influence of opium to allay pain and prevent spasm, and the bowels should not be moved or the sutures disturbed for six or seven days.

DISEASES OF THE PROSTATE.

The prostate is liable to inflammation, abscess, hypertrophy, tumours, and calculi. The two first-mentioned affections have already been described in a former part of this chapter.

Chronic hypertrophy is not usual before, but common after the age of 50. Mr. H. Thompson found that appreciable enlargement existed in 30 per cent of men above the age of 50; but that such an enlargement as to give rise to appreciable symptoms was only met with in 12 per cent. of the cases he examined. The enlargement may affect the organ generally, or the lateral lobes pretty uniformly, giving rise to widening and elongation of the prostatic portion of the urethra, or one lateral lobe, in which case the urethra will be twisted, or the middle lobe, giving rise to retention or difficulty in passing urine, as has already been explained. The enlargement is chiefly due to fatty degeneration, but sometimes it seems to depend on an increase of the natural structures without any great alteration of structure.

It is sometimes softer than natural, but more frequently the texture of the organ is indurated. The disease is readily distinguished by the physical symptoms discoverable on examination by the rectum, by the sense of weight in the perineum, tenesmus, the slowness and difficulty of passing water, and, as the disease advances, by the irritable condition of the bladder, frequent attacks of retention, and usually by the urine becoming loaded with mucus, and otherwise unhealthy, in consequence of the coats of the bladder and kidneys becoming diseased.

The treatment is chiefly palliative, and consists in the regulation of the diet and bowels, avoiding exposure to cold or fatigue, in soothing fits of irritation by hot hip-baths, and opiates by the rectum, in using means for improving the unhealthy character of the urine, in introducing the catheter at intervals to remove residual urine, if the bladder be not regularly emptied, and in relieving the bladder by the use of a prostatic catheter, in the introduction of which it is important to attend to directions which have already been stated in a former part of this chapter.

Tumours of a non-malignant character are by no means unusual in the prostate, and have been found to present three varieties :—1. Simple tumours, nearly isolated, and composed of closely packed organic muscular fibres with areolar tissue. 2. Tumours of the same nature, with more or less of the natural structure of the gland. 3. Tumours composed entirely of the ordinary structures of the prostate, more or less of a pyriform shape, presenting great diversities of size, and usually springing from the posterior median portion.

Hard and soft cancer of the prostate are both extremely rare.

Calculi may be formed in the dilated urethral canal, in the ducts of the prostate, or in both these situations. The most remarkable example on record is related by Dr. H. Barker. It weighed 1681 grains, was upwards of 4½ inches in length, and nearly of the same circumference at its largest part. It is composed of 21 portions, and must have been originally deposited in separate cells in the prostate.

CATHETERISM.

No surgical proceeding can be more easily accomplished than passing a catheter in ordinary circumstances ; and on the other hand, as has been acknowledged by the most eminent practical surgeons, there is not in the whole range of surgical proceedings a more difficult operation, or one that requires greater skill, caution, and experience, than that of passing the catheter through what is called an impermeable stricture.

1. *Ordinary proceeding.*—When there is no difficulty, the catheter may be passed into the bladder in the following manner :—The patient having been placed in the recumbent posture, a silver catheter having been selected, dipped in warm water and oiled, the surgeon takes

hold of the penis with his left hand, and raises it up; introduces the point of the instrument into the meatus, with the handle directed to the belly, and gently slides the catheter onwards, keeping the point along the upper aspect of the urethra. The instrument glides onwards until its point engages itself in the part of the urethra embraced by the deep fascia, when the handle should be gently depressed, the point being still kept along the roof of the canal, until it glides into the bladder. In no part of this movement should the slightest force be used; and it is unnecessary even to hold the penis in the left hand, except during the introduction of the instrument into the meatus and anterior portion of the canal.

2. *Another proceeding.*—The "tour de maître." The instrument having been prepared for use, its point is introduced into the meatus and sent along the upper surface of the urethra, with its convexity directed upwards, until its point is beneath the symphysis, when the catheter is made to perform a half turn from right to left, which brings the handle and concavity upwards. This manœuvre having been executed, the handle is depressed, and by the gentlest effort the point is slipped into the bladder. The only advantage of this mode is, that if the patient be sitting or standing, the front of the abdomen does not prevent a desirable position of the handle of the instrument in the first part of the proceeding.

CHAPTER XXII.

AMPUTATIONS AND RESECTIONS.

In his admirable work on Practical Surgery, the lamented Mr. Liston remarks, "The operation of amputation is not so frequently had recourse to now as heretofore, and the progress of surgical information will probably render it even more rare than at present." An excellent writer in the "Lancet," remarks, "The result of the progress of modern surgery has been to make the knife more daring than ever upon real occasions, but to keep it inactive, unless upon ample cause for its exercise. Never were human limbs held in greater respect and treated more conservatively than at present." Notwithstanding this gratifying progress in conservative surgery, there are still many cases where it is necessary to sacrifice a limb in the hope of preserving life.

The principal conditions which present this necessity are diseases of joints or bones, for which the operation of resection is unsuitable, and when the continuance of the disease must inevitably shorten life; cases in which a limb is so severely injured that the surgeon is firmly convinced its preservation is impossible; cases of chronic gangrene, after the formation of a line of demarcation; and cases of spreading gangrene produced by an external cause, such as a gun-shot wound, or compound fracture, or other injury, when there is a sound part in which the operation can be performed. However unpromising an operation may be in the last-mentioned circumstances, it affords the only chance of saving the patient's life. Such are the principal conditions which present an urgent necessity for resorting to amputation, and render its performance an unavoidable duty, for, as Dionis says, "it is better for the patient to live with three members than to die with four." There is also a class of cases in which amputation, though not absolutely necessary, may be said to be justifiable, namely, when a limb has from stiffness and an awkward position become not only useless, but extremely inconvenient. In such circumstances, when a patient expresses a strong desire to have the limb removed, the surgeon is justified in yielding to his solicitation; and the proceeding is then called an operation of "complaisance."

In all amputations of importance, one assistant is required to command the artery,—another to administer chloroform,—a third to take charge of the flaps, and to tie the arteries as they are seized by the operator,—and a fourth to hold the limb, and after its removal to hold the stump. Another assistant may be employed to hand instruments, sponges, ligatures, water, &c.; but it is better to have all these things conveniently placed, so that the surgeon may easily lay his hand on whatever he may require. Amputation can easily be effected with fewer assistants, but in a public hospital, or where they can be conveniently obtained, the proceeding may be conducted satisfactorily and speedily with the number mentioned above.

AMPUTATIONS OF THE UPPER EXTREMITY.

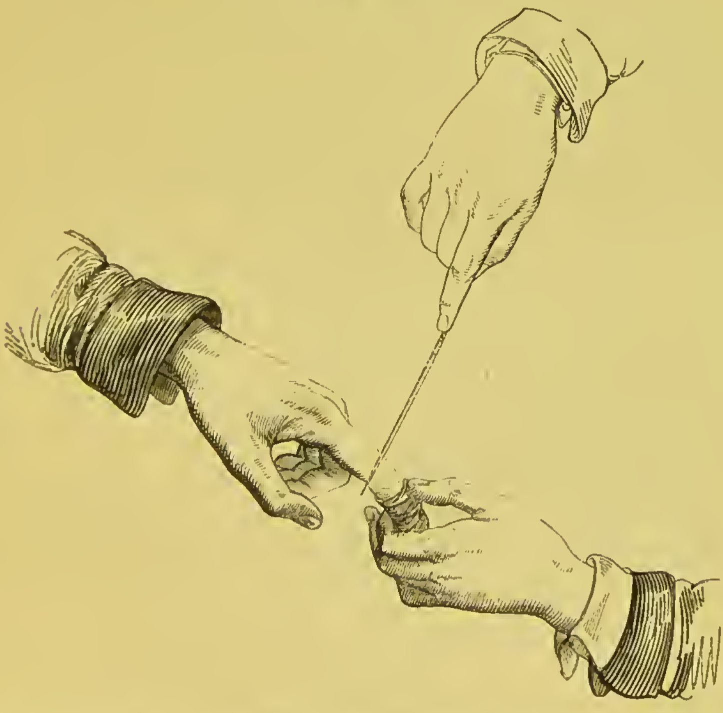
AMPUTATION OF A PART OR THE WHOLE OF A FINGER.

This may be accomplished either at one of the phalangeal articulations, or through one of the phalanges; the former operation is called by some, amputation in the contiguity, the latter, amputation in the continuity of the phalanges.

Amputation at any of the phalangeal articulations may be effected by any of the following modes; and the most convenient instrument for the operation is a narrow, long, straight bistoury, such as that represented below.

First proceeding.—A piece of bandage or surgeon's lint having been applied around the part to be removed, so as to afford a more secure

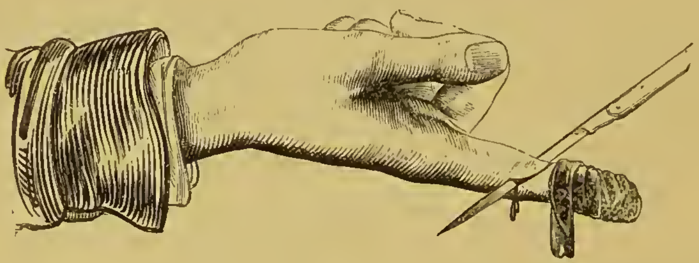
Fig. 234.



hold for the surgeon while making the necessary movements for facilitating the progress of the knife, place the hand in the prone position, take hold of the part to be removed, bend it slightly, apply the long, narrow, straight bistoury to the radial border of the joint, carry it across the joint to the inner side so as to make a lunated incision of the skin, then run the knife rapidly from point to heel across and into the joint, extend the finger when the knife is through the joint, and carry the knife forward parallel to the bone, and in close contact with it, bringing it out so as to finish with a semilunar flap, which must be sufficiently long to cover the extremity of the bone and to unite with the lunated extremity of the skin on the posterior aspect.

Second proceeding.—Place the hand in the supine position, extend the finger, transfix on the palmar aspect of the joint, carry the bistoury at first parallel to the bone, then bring it out so as to form a flap semicircular at the extremity, and sufficiently long to cover the bone, and unite with the skin on the dorsal aspect; then apply the knife to the front of the joint, carry it through the articulation, and divide the soft parts on the dorsal aspect without forming a flap, by bringing the knife to the surface.

Fig. 235.



AMPUTATION THROUGH ANY OF THE PHALANGES.

These operations are exceedingly simple, and easily performed. The following is the usual mode :—Place the hand in the prone position with the finger perfectly straight; transfix with the long, narrow, straight bistoury at the part where the bone is to be divided, and make a long flap on the palmar aspect; complete the division of the soft parts by a lunated incision across the dorsal aspect, making a short flap; and finish the amputation by dividing the bone with the bone forceps. Two arteries may be required to be tied in these operations; the soft parts should be brought into the proper position, and retained by means of a single stitch; a piece of lint dipped in water should be applied, and afterwards the part should be dressed in accordance with common principles.

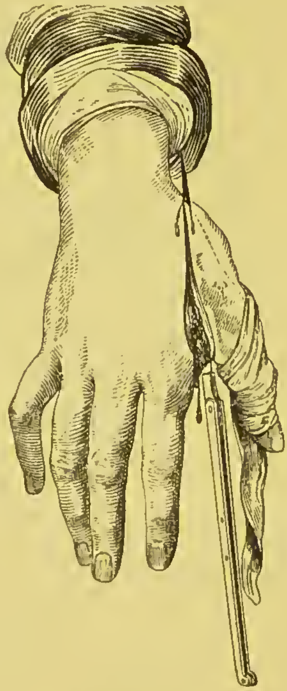
REMOVAL OF THE ENTIRE FINGER.

Without being at the time aware that Mr. Fergusson resorted to the same proceeding in cases where the entire finger required to be removed, I many years ago preferred removing along with it the extremity of the metacarpal bone to performing disarticulation at the metacarpo-phalangeal articulation. The execution of either operation is as easy as could be desired, but the former has the advantage of producing less deformity, as the adjoining fingers can be made to approach each other when the extremity of the metacarpal bone is removed, and it is surprising how little of an unpleasant appearance the hand presents in many instances after this operation. The best mode of proceeding is, to place the hand in the prone position, to direct an assistant to separate the fingers from the one to be removed, and then to make an incision along the posterior aspect of the metacarpal bone, beginning a little above the place where the bone is to be cut through, and terminating in two incisions, one extending along each side of the finger, and meeting each other a little in front of the palmar aspect of the joint. The soft parts should next be separated from the bone, the bone cut through with the bone forceps, and the finger and part of the metacarpal bone removed. After tying the arteries, the edges should be brought together by a stitch or two, and the fingers approximated. After the healing of the part, the only mark left will be a single straight cicatrix along the site of the operation, the soft parts being left perfectly entire on the palmar aspect of the hand.

AMPUTATION OF THE THUMB.

The phalanges of the thumb are amputated in the same way as those of the fingers. When both phalanges require to be removed, the metacarpal bone should be left entire. The operation may be very speedily effected in the following manner:—Commence an incision on the radial side of the carpus about half an inch higher than the articulation of the metacarpal bone with the os trapezium; direct it at first down along the line of the metacarpal bone, and afterwards along its external aspect to the fold of integument between the thumb and forefinger, introduce the point of the knife at this under extremity, carry it up on the palmar aspect of the bone, make it emerge at the commencement of the incision, and make the flap by cutting outwards. With one or two further touches of the knife the thumb may be detached, and after this operation there remains only a single line of cicatrix on the radial border of the hand.

Fig. 236.



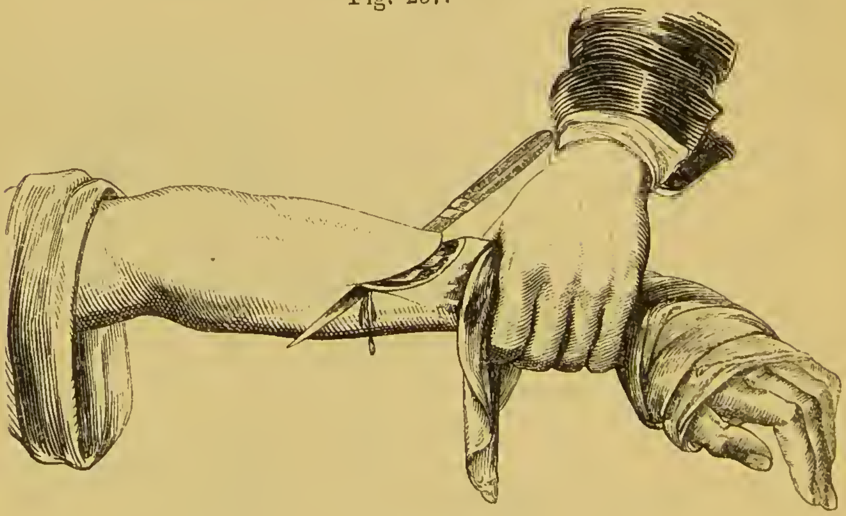
From Liston.

AMPUTATION OF THE FORE-ARM.

The preferable situation is the middle of the fore-arm. No particular advantage results from having the stump very long; and besides, the tendons in the under third are less convenient structures in the flaps than the fleshy parts higher up; on the other hand, a very short stump is less serviceable than one somewhat longer for the application of an artificial hand. The humeral artery should be commanded by an assistant, the hand placed in a state of pronation, and the muscles put into a uniform state of extension by an assistant holding and extending the under part of the fore-arm.

I generally give the preference to Mr. Liston's mode of performing this amputation, which consists in making the posterior flap first, and by cutting from the skin to the bone—a proceeding which has the advantage of enabling the surgeon to make the two horns of the semilunar flap extend sufficiently towards the radial and ulnar borders of the fore-arm to make it easy, after introducing the knife at one corner of this flap, to transfix in front of the bones, and bring out the knife at the other corner. The front flap is made by cutting towards the surface. The most elegant way of making the two flaps is, to place the edge of the knife against the skin on the posterior aspect; to run it up to the bone, making a sufficient flap, and with a movement of the knife to extend the incision towards the anterior aspect at the radial and ulnar borders; and then, without raising the knife, to introduce it at one edge of the wound, transfix, making the knife emerge at the other edge, and by cutting towards the skin make the anterior flap. Both flaps are thus made without once raising the knife from the fore-arm. The knife is then sent round and between the bones, and a clearance having been made for the saw, the two bones may be sawn at once without altering the position of the hand.

Fig. 237.



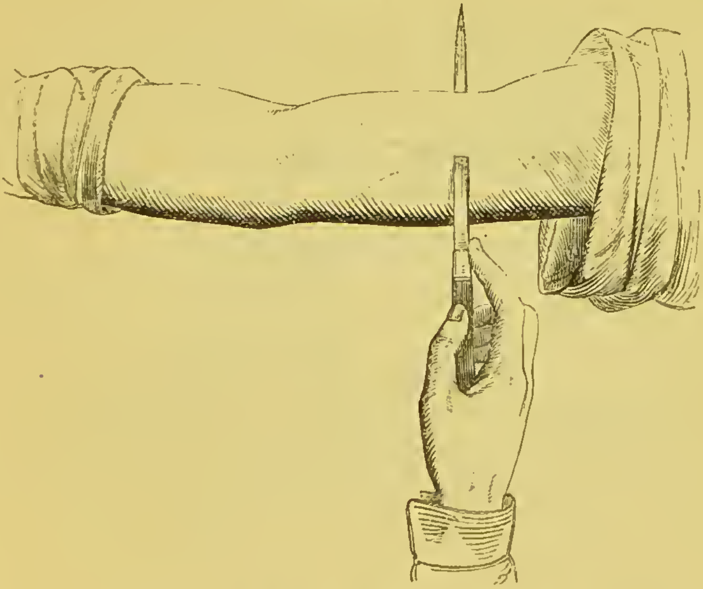
From Liston.

Another mode equally easy is to place the hand midway between pronation and supination, to take hold of the soft parts on the back of the fore-arm between the fore-finger and thumb of the left hand, to draw them away from the bones, and then to transfix with the view of forming the posterior flap by cutting outwards; but in transfixing, it is necessary to be careful to introduce the knife and to make it emerge as far towards the anterior aspect of the fore-arm as the bones will permit. The posterior flap is then made by cutting from within outwards. The knife is then introduced at one edge of the wound, sent in front of the bones, made to emerge at the other edge of the wound, and the anterior flap is formed by cutting from the bone towards the skin. The flaps should then be kept back, a clearance made for the saw by sending the knife round and between the bones, and the amputation completed by sawing the bones. In the one mode, the posterior flap is made by cutting from without inwards, in the other, from within outwards.

AMPUTATION OF THE ARM.

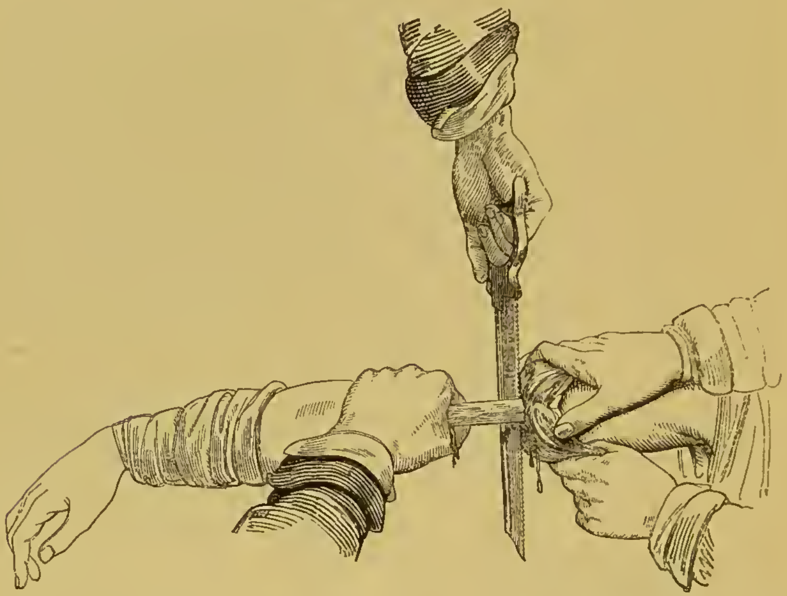
Chloroform having been administered, the arm removed from the side, and the humeral artery compressed by an assistant, the surgeon, placing himself so as to be able with his left hand to grasp the bone, while it is being sawn through, forms a neat round flap in front, and in doing so, directs the knife so as to leave the humeral artery in the posterior flap;—an assistant raises the flap; but at this stage it ought not to be retracted, as that would increase the difficulty of the next step, which is, to send the knife speedily behind the bone, and make a posterior flap of the same length and form as the anterior. In making these flaps, instead of carrying the knife parallel to the bone so far, and then cutting abruptly outwards it is better to direct the

Fig. 238.



knife towards the surface, so as to give a nice rounded form to the surface of each flap. Both flaps should then be powerfully retracted, the knife made to revolve round the bone so as to clear a space for the saw, and the bone sawn through close to the soft parts, the surgeon meanwhile holding it in his left hand; the artery should be secured, and the edges brought together by means of a few stitches.

Fig. 239.



AMPUTATION AT THE SHOULDER-JOINT.

It would answer no useful purpose to describe the numerous different proceedings which have been adopted in the performance of this operation. It may be very speedily and easily effected in the following manner:—The patient should be placed on a table, with the shoulders raised, that on which the operation is to be performed projecting beyond the edge of the table. One assistant is required to administer chloroform and watch its effects; another, to compress the subclavian artery where it passes over the first rib; and when the patient is under the influence of chloroform, it is easy to command the artery completely, chiefly, I believe, because the patient, not being conscious of any uneasiness, makes no efforts to move the body, and so the pressure is not diverted from the proper part; a third assistant is ready to raise the upper flap, and to follow the back of the knife so as to compress the second flap when the vessels are divided in completing it; and a fourth to hold the arm, and when the arm is removed, to tie the arteries as they are taken up by the surgeon. In operating on the left side, the surgeon should introduce the knife at the posterior border of the axilla, send it in front of the bone, and make it emerge at the anterior border of the deltoid, about an inch below the point of the acromion process, and by cutting from the bone towards the skin, a large flap is made, chiefly of the deltoid muscle and integument; this flap is raised up by an assistant, and until it is completed, the arm should be kept away from the side, but then brought in front of the chest so as to give prominence to the head of the bone and the capsular ligament. The knife is next brought against the joint, carried through it to the inner side of the bone, as here represented, brought down so far by the side of the bone, and then made to emerge, completing the flap. The back of the knife should be followed by the hand of an assistant ready to

Fig. 240.

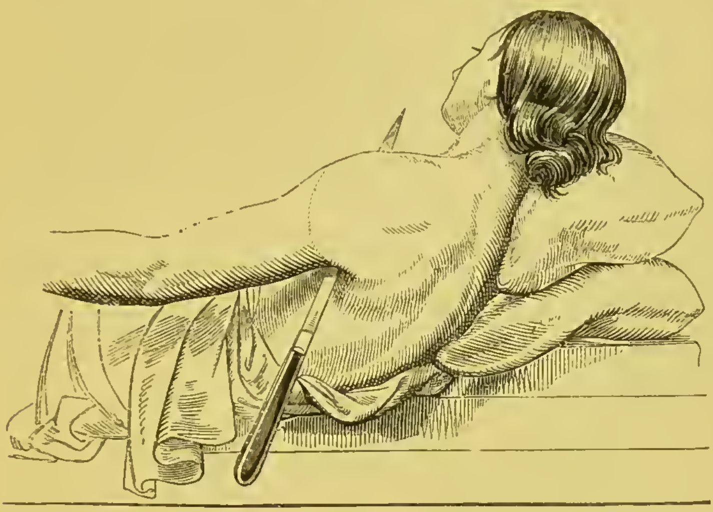
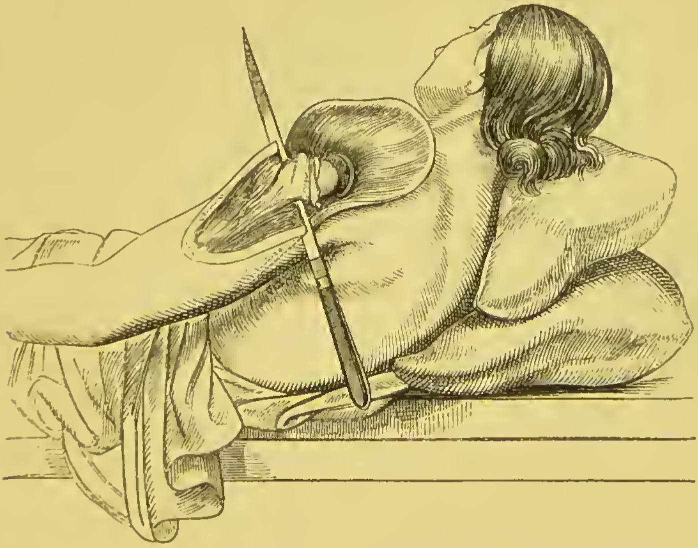


Fig. 241.



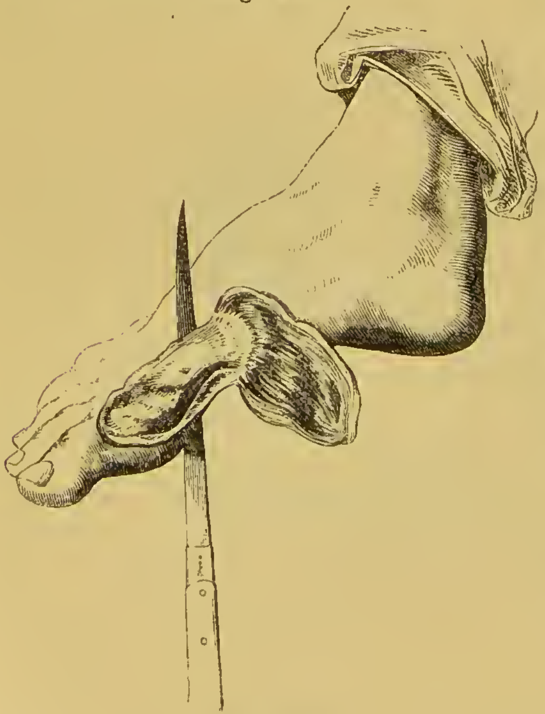
grasp the flap containing the principal artery, as soon as the surgeon is about to complete the flap. When the knife is fairly into the joint, the arm should be removed from the side, to give freedom to the knife in making the under flap. In operating on the right side, the only difference is, that it will be found more convenient, in making the upper flap, to introduce the knife at the anterior border of the deltoid, about an inch below the acromion process, and make it emerge at the posterior border of the axilla : in other words, the direction of the knife in making the upper flap, when the operation is on the right side, is exactly the reverse of its direction when the operation is on the left; in the former case it is made to penetrate at the anterior border of the deltoid, and to emerge at the posterior border of the axilla; in the latter it enters at the posterior border of the axilla, and is brought out at the anterior border of the deltoid. The axillary artery and other vessels having been tied, the edges of the flaps are brought together by a few stitches, and the wound dressed in accordance with common principles.

AMPUTATIONS OF THE UNDER EXTREMITY.

AMPUTATION OF THE TOES.

For the amputations of the toes, except the great toe, at any of their joints, the proceedings are the same as for the amputations of the fingers, except that when the whole of the phalanges of a toe require to be removed, the extremity of the metatarsal bone should be allowed to remain, as it is undesirable to diminish unnecessarily the breadth of the foot. Amputation of the great toe is frequently required for disease of its metatarsal bone, and it may be very easily and quickly performed by either of the following methods :—

Fig. 242.



After Liston.

First method. — Commence the first incision at the upper part of the proximal extremity of the metatarsal bone and on its tibial aspect, carry it forward to the distal extremity, direct it along the inner side of the joint to the plantar aspect of the foot, and extend it backwards to the part opposite to its commencement. This flap having been directed back, send the knife between the bones and cut outwards through the commissure between the first and second toes. By a touch or two of the knife the metacarpal bone may then be separated from the internal cuneiform. The operation is exceedingly simple by this method, and the result generally very satisfactory.

Second method.—Commence the incision about half an inch behind the proximal extremity of the metatarsal bone, and continue it forwards to about the middle of the bone, and then make it divide into two, meeting each other on the plantar aspect of the digital commissure. Detach the soft parts from the bone, and then disarticulate from the internal cuneiform. This is an excellent mode of performing the operation, and I generally give it the preference. It leaves only a single line of cicatrix along the inner part of the foot. The same operation answers when it is unnecessary to remove the whole of the metatarsal bone, the only modifications being, that it is not requisite to carry the incision so far back, and that the bone must be cut by the bone-forceps,—in doing which it is advisable to cut in a slanting instead of a transverse direction, as the alteration of the outline of the foot on its inner side is thus rendered less abrupt, and the part is consequently less exposed to be irritated by pressure.

AMPUTATION OF THE FOOT.

Hey's operation.—This consists in performing amputation between the tarsal and metatarsal bones; and of the many methods adopted for its performance, I think the following the preferable:—The leg having been firmly placed on a table, beyond the edge of which the foot projects, and being secured in its position by an assistant, the surgeon takes hold of the forepart of the foot with the left hand, and having made sure of the extremities of the metatarsal bones of the great and little toes, if the operation be on the right foot, he inserts the knife on the edge of the foot a little behind the prominence of the metatarsal bone of the little toe, carries it directly forward on the edge of the foot for nearly an inch, directs it in a semilunar manner on the dorsum of the foot to the base of the metatarsal bone of the great toe, and then carries it back for nearly an inch on the inner edge of the foot. The parts should be cut through boldly down to the bone, and the short flap brought back, and the situation of the tarso-metatarsal articulations exposed. The knife is next introduced at the extremity of the incision on the inner edge of the foot, sent underneath the bones, and made to emerge at the outer edge of the foot at the commencement of the first incision, and a long flap is made from the sole of the foot, sufficiently long to cover the ends of the bones and to unite with the short flap on the upper part of the foot. The surgeon then presses heavily on the forepart of the foot, so as to make it more easy to send the point of the knife into the articulations between the bones; and this having been done, the operation is speedily completed. The long flap covers the extremities of the bones, and a single cicatrix along the upper part of the stump is the only permanent mark of the operation.

This is generally a very satisfactory operation in cases for which it is suitable. The only differences to be observed when the operation is on the left foot are, 1st, that it is more convenient in making the first incision to commence behind the base of the metatarsal bone of the great toe, and to make it terminate behind that of the little toe; and, 2nd, that in transfixing to make the long flap below, it is more convenient to insert the knife at the outer, and to make it emerge at the inner edge, of the foot.

In performing this operation an elegant proceeding is, after making the upper flap, to transfix without raising the knife from the foot, so that the upper and under flaps are made by one continued movement of the knife.

Chopart's operation.—This operation, improved by modern surgeons, retains the name of Chopart, who first performed it. It consists in performing amputation at the medio-tarsal articulation, or, in other words, at the articulation formed by the astragalus and calcaneum behind, and the scaphoid and cuboid bones in front, the astragalus and calcaneum being the only two bones that are left. The site of the articulation is first sought for, and the best guides for finding it are, the projection of the scaphoid bone on the inner side, immediately behind which is the articulation, and the projection of the base of the fifth metatarsal bone on the outer edge of the foot, about half an inch behind which projection, and about midway between it and the anterior part of the malleolus externus, is the outer part of the articulation. These guides having been found, a short flap is formed above and a long one below, and the proceeding is in all respects similar to that in Hey's operation, except that the incisions are commenced further back, namely, about half an inch behind the guides already mentioned on the margins of the foot.

AMPUTATION AT THE ANKLE-JOINT.

The following are Professor Syme's directions for the performance of this amputation:—"The foot being placed at a right angle to the leg, a line drawn from the centre of one malleolus to that of the other directly across the sole of the foot will show the proper extent of the posterior flap; the knife should be entered close up to the fibular malleolus, and carried to a point on the same level of the opposite side, which will be a little below the tibial malleolus; the anterior incision should join the two points just mentioned at an angle of 45° to the sole of the foot and long axis of the leg. In dissecting the posterior flap, the operator should place the fingers of his left hand upon the heel, while the thumb rests upon the edge of the integuments, and then cut between the nail of the thumb and the tuberosity of the os calcis, so as to avoid lacerating the soft parts, which he at the same time gently, but steadily, presses back, until he exposes and divides the tendo Achillis. The foot should be disarticulated before the malleolar projections are removed, which it is always proper to do, and which may be most easily effected by passing a knife round the exposed extremities of the bones, and then sawing off a slice of the tibia connecting the two processes."

Since 1839, I have always performed Syme's operation without disarticulating the foot. In the operation of that truly great surgeon, and in my slight modification of it, the incisions, the section of the bones, and the results are precisely the same; both the operations can be performed with equal ease and elegance; and the only difference in the two proceedings is, that Syme disarticulates the foot and then saws off the ends of the bones, whereas I prefer shortening the proceeding by sawing through the bones, in precisely the same situation, without disarticulating the foot.

Modification of Pirogoff's amputation.—Pirogoff devised a mode of amputation, the objects of which are, to have a longer stump better adapted for support, to leave the tendo Achillis undisturbed, to have no hollow flap, to leave the posterior part of the calcaneum, and to bring the cut surface of that bone into contact with the tibia. In his operation for obtaining the above-mentioned conditions, he disarticulates the foot, saws off the malleoli, and by means of a saw removes the anterior part of the calcaneum, and with it the foot, after disarticulation has been effected. While perusing the description of Pirogoff's operation within a week after its publication in this country, the idea at once and naturally occurred to me that the operation would be greatly simplified and improved by applying to it the modification I had previously adopted in Syme's amputation. I felt greatly interested in the subject, and, after due consideration, resolved to recommend and adopt the following procedure, which seems to me to make this amputation one of the most simple operations any surgeon can be called upon to perform :—

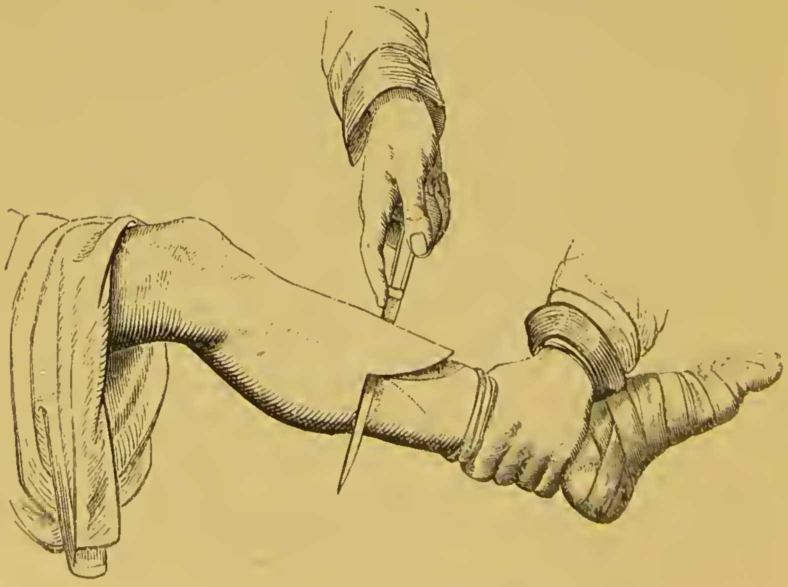
The patient being laid on the table, the surgeon—whichever foot be the subject of operation—being placed on the left side of his patient, with the heel, in the first step of the operation, directed towards himself, and having with his left hand taken hold of the soft parts, and drawn them a little backwards, so as to secure greater breadth of flap, inserts the knife on one side in front of the malleolus, carries it down across the sole of the foot, and upwards to the corresponding point just at the front and upper part of the other malleolus, taking care to direct the incision so as to pass opposite to the part where the posterior portion of the astragalus rests upon the calcaneum, and to use the knife energetically, so as to cut through all tissues down to the bones. By this single movement of the knife, a clearance is made for the saw, by a few movements of which the portion of calcaneum behind the astragalus is speedily cut off from the rest of the bone, the section being from below upwards and a little backwards, so that the portion remaining in the flap will be a little longer from behind forwards—below than above. The assistant having slightly changed the position of the leg, so as to make its posterior part to rest upon the table, the surgeon, by a second movement of the knife, unites the extremities of the first incision by a slightly semilunar incision, using the knife boldly, so as to cut through every tissue in front of the bones, and then, by a few slight touches below, admits of the flap being brought back, and makes a clearance for the saw. By a few movements of the saw, the bones are cut through immediately above the ankle, and this extremely simple amputation is completed by little more than two movements of the knife, and two sets of movements of the saw.

During the second week after the publication of Pirogoff's amputation, the operation as now described was demonstrated by me on the dead body to a large number of medical students; in each winter session since that publication, it has been performed on the dead body in presence of a very large surgical class in this University; and it was performed by me on the living body in the Royal Infirmary, in the first case suitable for the operation which presented.

AMPUTATION OF THE LEG.

An excellent and speedy mode of performing this operation, and that which I have usually adopted, is the following:—The circulation being commanded by pressure on the femoral artery, the surgeon

Fig. 243.



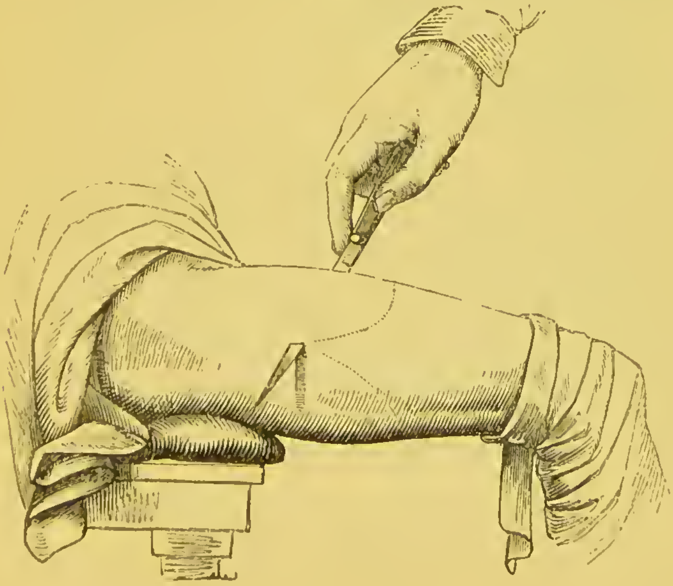
being placed on the left side of the patient, applies the knife near its heel to the right side of the leg, and draws it across to the left side in a semilunar direction, so as to form a short anterior flap, and then without raising the knife transfixes the leg, the knife entering and emerging at the extremities of the first incision, and a long posterior flap being formed by cutting from the bones to the surface. The soft parts between the bones underneath may be cut before the knife is brought to the front of the leg, and then by a few touches the short flap in front is brought back, the soft parts between the bones divided, and a clearance made for the saw. The surgeon being on the left side of the patient is able to hold the bones with his left hand during the movements of the saw. The projecting angle of the tibia should be removed by the saw or bone-forceps, that it may not irritate the integument over it.

Another and a very easy method is to form the posterior flap in the first instance; and with that view the operation is commenced by transfixing the leg. The points of transfixion are then connected together by a semicircular movement of the knife across the front of the leg, and the flaps having been turned back and the bones cleared by carrying the knife around and between them a little above the points of transfixion, the amputation is completed by sawing the bones. The accompanying illustrations will make this operation perfectly intelligible.

AMPUTATION OF THE THIGH.

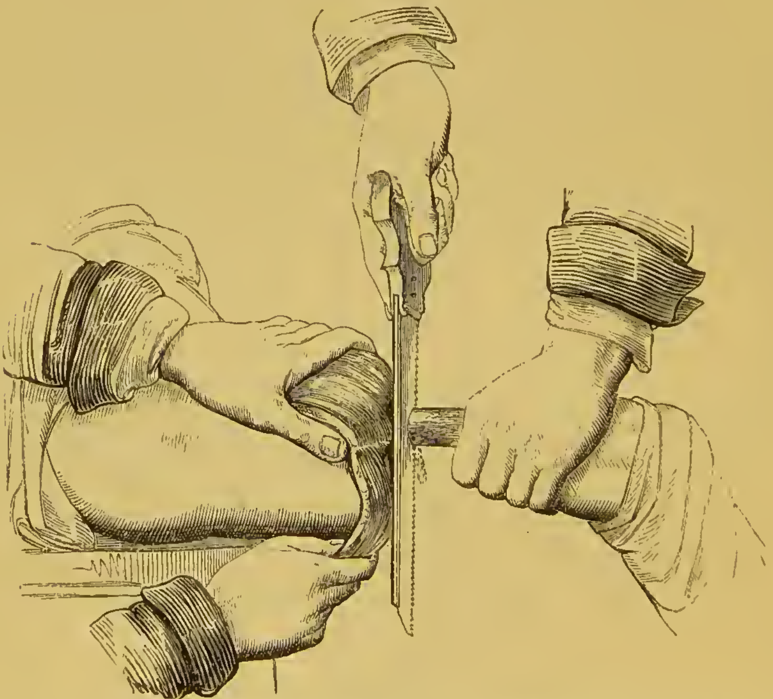
The patient having been properly placed, the artery compressed by a trustworthy assistant, and the leg held in the proper position by another assistant, the surgeon, if the operation be on the left thigh,

Fig. 244.



stands on the fibular side of the limb, and having taken hold of the soft parts in front of the bone with his left hand, raises them a little, and performs transfixion by introducing the knife on the outer side, carrying it across in front of the bone, and making it emerge on the inner side, and then forms the anterior flap by cutting towards the surface. An assistant then simply holds up the flap without retracting it at this stage, and the surgeon sends the knife behind the bone about an inch lower than the commencement of the first incision. The advantage of observing these two directions is, that the knife is more readily sent behind the bone without touching the skin on either side. The knife is then brought to the surface in the direction represented by the dotted line in the accompanying engraving, and by this movement the posterior flap is formed. This flap should be a little longer than the anterior to compensate for the greater retraction which takes place in it, owing to its muscles having less connexion with the bone than those of the anterior flap. An assistant retracts both flaps very forcibly, and the surgeon makes the knife revolve round the bone so as to effect a clearance for the saw. He then grasps the bone in his left hand, and saws it through, close to the soft parts, moving the saw in a vertical direction. The only differences in operating on the right thigh are, that the surgeon stands on the tibial side, and introduces the knife on this, instead of the fibular aspect. If, however, in this case there be the least prospect that his standing on the tibial side may cause an awkwardness or want of proper freedom for making the necessary movements of

Fig. 245.

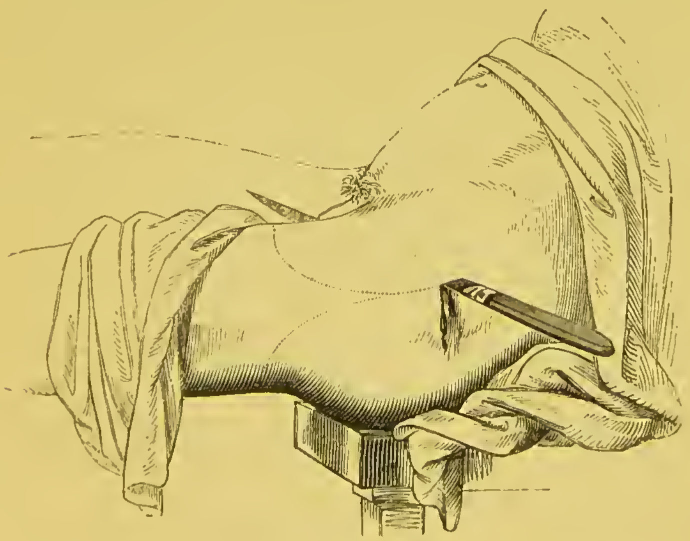


the knife, the operation can be performed with perfect facility and convenience when standing on the other side: only the bone, while it is being sawn, cannot then be conveniently held by the left hand of the surgeon.

AMPUTATION AT THE HIP-JOINT.

The cases in which it is necessary to resort to this operation are not numerous: and this is fortunate, for although a sufficient number of successful cases are on record to make it perfectly justifiable on the part of the surgeon to resort to it in extreme circumstances, and although there is no difficulty in executing the operation, which can be performed in the living body with great ease in less than twenty seconds, yet it is proved beyond doubt, that as regards ultimate consequences, it is an exceedingly perilous proceeding. In the only instance in which I have performed it in the living body, and often when I have performed it in the dead body before my class, the operation has not occupied even so much time. I mention this merely to show that there is no difficulty in performing it. The following observation of Liston should be strongly kept in view:—"These operations must be undertaken with determination, and completed rapidly, in order that dangerous effusion of blood may be prevented; they are not to be attempted without great consideration, and only under very pressing circumstances." From much practice in performing this operation on the dead body, I have arrived at the conclusion that Liston's method is preferable to any other. He commenced transfixing by introducing the knife midway between the anterior superior spinous process of the ilium and the trochanter major of the femur. The following description and illustration, taken from his admirable work on Practical Surgery,

Fig. 246.



will make his method perfectly intelligible :—"By forming the flaps from the anterior and posterior aspects of the limb, the bone may be exposed and sawn at the inner trochanter, or it may be removed at the joint. In making the incisions thus high, the common femoral is compressed, as it passes over the brim of the pelvis, and an assistant must follow the knife with his hand, and grasp firmly the anterior flap, whilst others are ready to compress those of the posterior as soon as the sawing, or disarticulation, is completed. This mode of getting at the head and neck of the bone is much preferable to that usually followed, and is in every respect safer, as I have more than once ascertained from actual practice on the living body. The fore-part of the articulation is fully exposed immediately on the anterior flap being formed. The capsular ligament is cut by drawing the knife across determinedly, as if it were the intention of the operator to cut off the head of the bone. The round ligament and posterior portion of the capsular are cut, and the blade of the instrument having been passed behind the neck and trochanters, the posterior flap is quickly formed, so as to allow the limb to drop. The vessels on the posterior aspect are first tied; then the femoral and those in the anterior flap, which has been commanded by the assistant, are uncovered one by one and secured."

AMPUTATION OF THE PENIS.

The part to be removed is covered with some lint, laid hold of by the left hand, put upon the stretch, and then removed by one stroke of a long knife moved rapidly across the organ. Such vessels as require ligature having been secured, the surgeon lays hold of the mucous membrane of the urethra by means of a forceps, and divides it into four equal flaps, by four cuts with a pair of scissors, and then by four small sutures of fine thread unites each flap to the common integument. The skin and mucous membrane unite together, and the contraction of the cicatrix has the effect of keeping the urethra open and of sufficient calibre.

RESECTIONS.

Under this title are comprehended the removal of the articular extremities of bones—in other words, excision of joints—the resection of long bones in their continuity, and the partial or entire removal of certain bones. One of the earliest, if not the first operation actually performed of this kind on record, is excision of the knee-joint, by Filkin of Liverpool, in 1762. Very soon after this, Vigaroux and David removed the head of the humerus, but their operations were not published until after the upper part of the same bone had been removed by White of Manchester, in 1768. Mr.

Park of Liverpool was the first to propose, but the celebrated Moreau was the first who performed, excision of the elbow-joint.

RESECTION OF THE SHOULDER-JOINT.

The many different methods which have been adopted for this operation may be almost all reduced to one or other of two principal methods, namely, that in which the bone to be removed is exposed by making a flap, and that in which it is exposed by means of a simple incision. Of these two methods it may be stated generally, that the latter is sufficient, and should be preferred when the operation is performed for the purpose of removing the crushed head of the bone, yet in most cases where it is employed for the removal of diseased bone, the former will be found the preferable proceeding. The directions for the performance of the operation by means of a flap are very simple :—Make a vertical incision from the apex of the acromion along the middle of the deltoid to near its insertion, and from the under extremity of this incision make another upwards and backwards, cutting in a semilunar direction towards the posterior border of the axilla ; raise up the flap, which will comprehend the external portion of the deltoid ; open the joint ; detach the muscles which are inserted into the tuberosities ; thrust out the head of the bone, and saw it through, carefully guarding against injuring the soft parts. M. Bauden relates 14 cases in which this operation was practised for injuries during the Crimean campaign, of which only one proved fatal.

RESECTION OF THE ELBOW-JOINT.

The operation may be performed in the following manner :—The patient having been placed in the prone position with the elbow semiflexed resting on the edge of a table, and presenting its posterior aspect to the surgeon, the joint is conveniently exposed by a wound in form resembling the letter H ; and the performance of the operation is exceedingly easy, if that form of incision be adopted. The parallel portions of the wound may be two inches long, and the transverse portion should extend from the very margin of the outer tuberosity of the humerus along the upper part of the olecranon process to as near the inner tuberosity as may be without endangering the ulnar nerve. The two square-shaped flaps having been detached from the subjacent parts, the soft parts behind the condyles deflected laterally without injuring the ulnar nerve, and the bones brought into view, the olecranon process should be cut through with the bone-forceps, and the lateral ligaments divided. After which the humerus can easily be made to protrude, and be sawn off through the tuberosities. The head of the radius, and the portion of the sigmoid cavity of the ulna left after the division of the olecranon process, should be removed by the bone forceps or saw, and bleeding having been arrested, the edges of the wound should be brought together, and the arm secured in a semi-flexed position. A most useful joint formed by ligamentous union is the usual result. I have now performed this operation thirty-five times, and with one exception all the patients have done well. I have practised every form of incision, and although the H incision makes the performance of the operation very easy, I now invariably prefer the single longitudinal incision. By this form of incision, the soft parts are left in the best possible state for steadying the cut ends of the bones. Ferguson's Lion Forceps is of great service for steadying the bones while being sawn, and Heath's splint is an admirable appliance for the accomplishment of all that can be desired from the use of a splint in the treatment after operation.

EXCISION OF THE WRIST-JOINT.

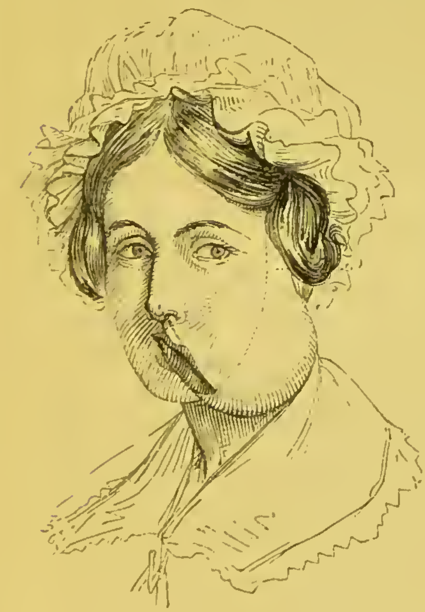
Excision of the wrist-joint is far seldomer practicable and always less hopeful than excision of the elbow-joint, as will easily be understood by reflecting on the anatomy of the two joints. From the great complexity of the wrist-joint, excision can be resorted to in a very few cases; but still there may occur some in which the surgeon may justifiably and also hopefully perform the operation. Thus Mr. Butcher of Dublin met with a case, in which there was great swelling of the wrist-joint, and satisfactory proof of advanced disease of the bones forming the radio-carpal articulation, but of perfect soundness of the metacarpal bones and phalanges, and of undiminished power of the fingers and thumb. In operating on this case, Mr. Butcher commenced by making a curved incision, extending from a little below the wrist, two lines on the ulnar side of the extensor secundi internodii pollicis tendon, down to the carpal extremity of the metacarpal bones, and then running upwards to a point fully half an inch above the original point of departure. On dissecting up this flap the diseased bones were brought clearly into view. In the next step the soft parts were carefully separated from the extremities of the radius and ulna, together with the second extensor tendon of the thumb, which was separated from its groove in the radius. After the ligamentous attachments of the diseased bones were removed, and the soft parts in front sufficiently detached, the hand was bent down, by which the carious bones were made to project, and, in consequence, their diseased ends were easily sawn through by Mr. Butcher's saw. Lastly, the diseased carpal bones, with the exception of the trapezium, which was unaffected, were dissected out, the flaps were laid down and properly secured, and the hand and arm placed in the prone position on a padded splint. By this method of operating, Mr. Butcher secures for his patient the proper use of the thumb, as its extensor tendon remains untouched by the knife. Other methods of operating have been proposed and practised, but the exact method of procedure must depend entirely on the state in which the joint is found in each particular case.

I have twice performed the operation of excision of the wrist-joint; once in the Aberdeen Hospital, and once in private practice. In the latter case I operated according to Mr. Butcher's method, and the result was a serviceable hand with three of the fingers decidedly bent. In the former case, I made a long and straight incision behind, deflected the tendons to each side, and removed the whole of the carpal bones along with the extremity of the radius; and the gratifying result was, that the patient had a most serviceable hand, and enjoyed the full use of all her fingers.

REMOVAL OF THE UPPER JAW.

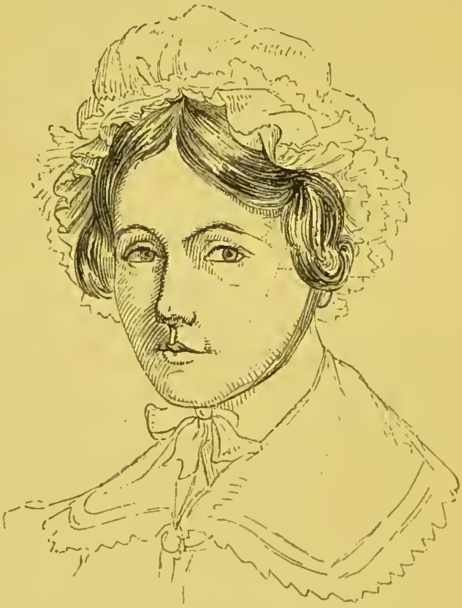
Of the various methods which have been adopted for the removal of the whole of the upper jaw, the following is one of the best:—After removal of one of the central incisors, two incisions are made, one from within half an inch of the inner canthus of the eyelids along the side of the nose, round the ala, which it detaches, and through the centre of the lip; the other from the junction of the malar and maxillary bones to the angle of the mouth. The flap is dissected up to the margin of the orbit. The nasal process is then divided by strong cutting pliers, one blade being introduced into the orbit and the other into the nose; by the same instrument it is separated from the malar bone; the palatine arch and alveolus are next notched with a narrow-bladed saw, and then cut through by the pliers; the bone is then pushed down, and detached, care being taken to preserve, if possible, the palatine process of the palate bone and the velum

Fig. 247.



From Liston.

Fig. 248.



From Liston.

palati. The two sketches here introduced show the appearance before and after the removal of the superior maxilla and os malæ by Mr. Liston. In addition to the usual proceedings, the zygomatic arch and the junction of the malar with the frontal bone were divided by the cutting pliers. The patient was quite well ten years after the operation. "If the malar bone and also the orbital plate of the superior maxillary be sound, they should both be left; and for this purpose a notch should be made with the saw across from the nasal process of the latter to the outer margin of the former, and then the forceps should be used, first to complete the division between the mouth and nose, next to cut through the nasal process of the superior maxillary, and then to pass along the horizontal groove already made with the saw, below the orbit."

Mr. Fergusson has for some time practised a modification of this operation, which in many, perhaps in most cases, should be adopted. The modification consists in making a single incision through the centre of the upper lip along the base of the columna into the nostril; and he writes,—"I believe that any amount of disease, on which it might be deemed reasonable to operate, could be removed through such a wound as I have recommended."

I have been very much struck, after operations by others and by myself, how much the cavity contracts, how slight traces remain on the face after such formidable proceedings, and to what an extent defects in the mouth may be remedied by artificial appliances.

RESECTION ON THE LOWER JAW.

The mode of performing resection of the lower jaw must vary according to the situation and size of the tumour, and the extent of the part to be removed. In many cases, the method of procedure adopted by me in the case of tumour of the lower jaw in a young man, whose appearance before and after operation is here delineated, will be found suitable. I commenced my first incision at the middle of the lower lip and extended it downwards over the middle of the chin, to a little below the margin of the diseased bone. From the termination of that incision, I ran the scalpel along the entire inferior border of the bone, turning up behind the angle and ending about midway between it and the condyloid process. The extensive flap contained within those incisions was next dissected up, and laid upon the upper part of the face, so as fully to expose the diseased portion of the bone. The jaw was then sawn through, immediately at the left side of the symphysis, and afterwards obliquely through the ascending ramus, opposite the last molar tooth, particular care being taken to protect the vessels by pressing them inwards. The section of jaw was then carefully relieved from its internal soft attachments by drawing the knife along its internal surface, keeping its edge close upon the bone. The diseased soft parts connected with the openings of two abscesses on the cheek, and some diseased tissues in the upper region of the neck, were then cut out, and after suppressing the hemorrhage, which was excessive, the flap was brought down, and by means of a few stitches and adhesive plaster the edges of the wound were kept in apposition. About four weeks afterwards, union was entirely effected, leaving so little external deformity as to show very slight traces of such an operation.

Fig. 249.

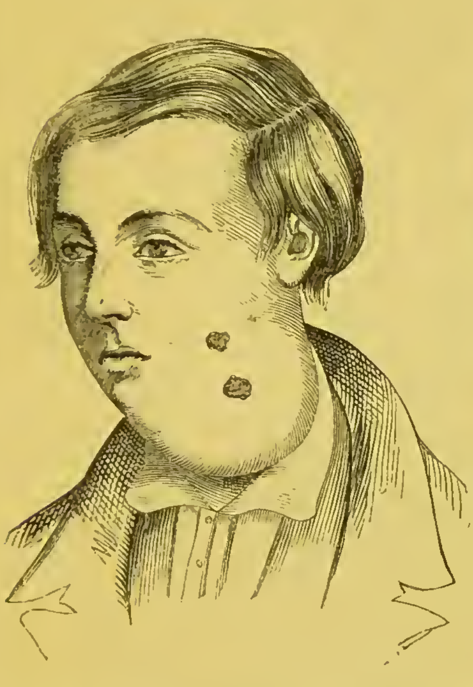
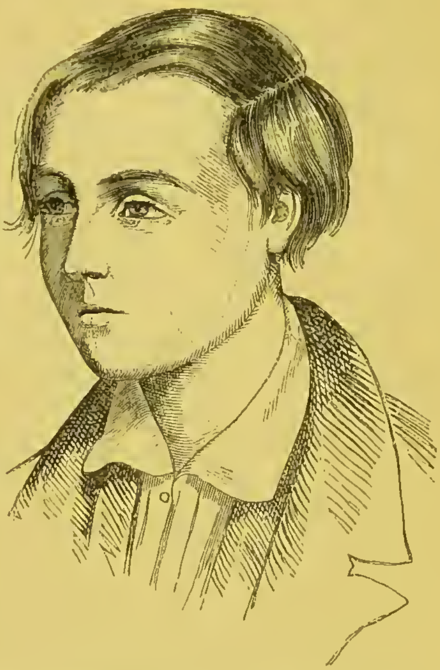


Fig. 250.



Mr. Liston gives the following description of the proceeding for a more extensive removal :—“ To illustrate the operation, we shall suppose that the tumour involves nearly one side of the bone, and that division near the symphysis with disarticulation is to be performed. An incision is made from the condyloid process, down the posterior border of the ramus and along the lower margin of the bone, and terminates above the point of the chin, in the mesial line, at about an inch from the free edge of the lip. The flap so formed is dissected up, the membrane of the mouth is divided on each side of the bone, and the tumour thus perfectly exposed. Another incision about an inch and a half long may then be carried in the course of the external carotid, and made to meet the other opposite angle of the bone. A tooth, say the central incisor of the affected side, having been previously removed, a small saw is applied so as to cut the bone to the required depth near the symphysis ; the cutting forceps are placed in the notch, and the bone clipped through. The cut end is now laid hold of, the tumour depressed, and the attachment of the temporal muscle separated from the coronoid process. The masseter muscle has been detached along with the coverings of the tumour. The bone having been thus thoroughly loosened, the articulation is opened from before; and by carrying the bistoury close to the bone, the pterygoid muscles and other attachments are also divided, and the operation completed.

Fig. 251.

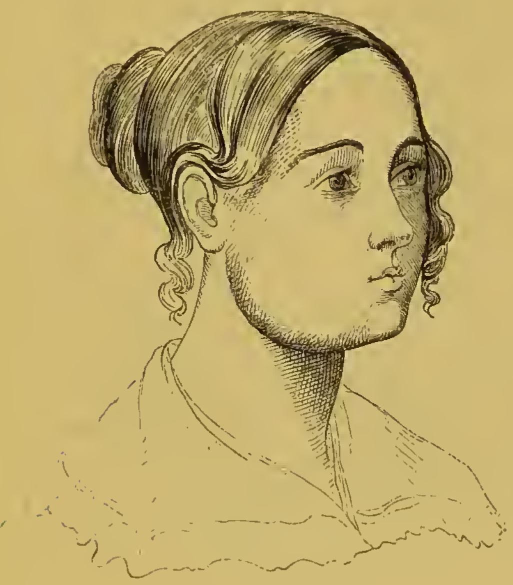
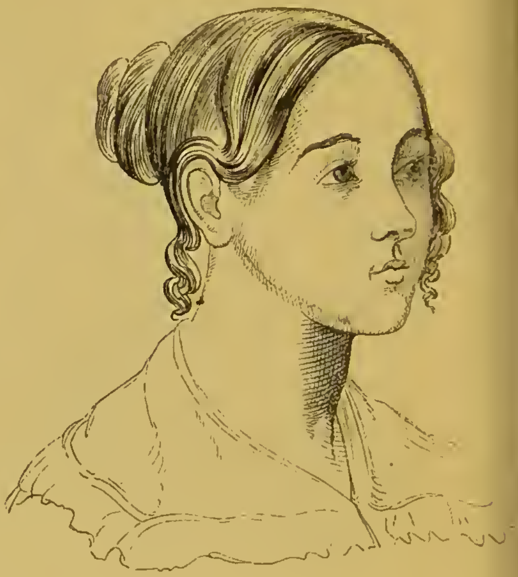


Fig. 252.



The bleeding is now arrested by ligature of the vessels, and much time and trouble will often be saved by at once looking for and securing the common trunk of the temporal and internal maxillary arteries, as they immerge from under the border of the posterior belly of the digastric muscle. Effectual means having been taken for arresting hemorrhage, a bit of lint is placed in the wound, and the flaps lightly replaced. About five or six hours after the operation, the edges of the wound may be neatly approximated and retained, excepting a short distance at the middle, to permit the passage of the ends of the ligatures."

EXCISION OF THE JOINTS OF THE LOWER EXTREMITY.

Excision of the Hip-joint.—At page 444, this operation is described, and the statistics of it given, as far as I have been able to ascertain them.

Excision of the Knee-joint.—Whatever opinions may be entertained by many regarding the merits of this operation, it cannot be denied, that in the manner it is now performed, it is one of the simplest and easiest proceedings in surgery. Mr. Fergusson, who revived the operation, recommends an H incision, the cross line, about four inches long, running below the patella. Most surgeons prefer a semilunar incision. In accordance with the practice of the majority of surgeons who have performed this operation, the semilunar incision was adopted in the Aberdeen Hospital in three cases in which one of my colleagues operated, and two in which I did, and nothing could be more convenient. The operation may be easily performed by making a semilunar incision, the convexity of which extends to the tuberosity of the tibia, and its extremities placed over the condyles of the femur; by dividing the ligamentum patellæ, and raising up the patella in the semilunar flap; by cutting the crucial and lateral ligaments; by forcibly bending the knee, and cautiously making a clearance for the saw; and by removing the articular surfaces of the femur and tibia. In the last part of the operation, it is important to avoid denuding the bones to a greater extent than is absolutely necessary, to saw off as little of the bones as may be compatible with the removal of the whole of the disease, and to avoid obliquity, so that the sawn surfaces may rest evenly and flat against each other. The slice from the femur should first be sawn off, and then that from the tibia, which can be safely done by applying Butcher's saw to the posterior part of the tibia, and sawing the bone from behind forwards. If the cartilage of the patella be sound, it may be pared off; if the bone be diseased, or softened, the diseased parts must be cut off, or the bone entirely removed; all diseased synovial membranæ, all infiltrated tissue, and all clots of blood should be carefully removed, and vessels completely secured, before the limb is placed in a straight position. The edges of the wound having been brought together and secured by sutures, the limb, after having been made perfectly straight, with the surfaces of the bones in perfect apposition, should be put up securely at once on Liston's splint—every part being comfortably supported by padding. Many varieties in the mode of procedure have been recommended. Mr. Jones of Jersey, whose success in this and many other departments of surgery has been great, has advised that the integument be raised up by a semilunar incision, that the ligamentum patellæ, the patella, and quadriceps tendon, be pushed to one side, and that the joint should then be opened, and the bones sawn through. Mr. Butcher has recommended that the hamstring tendons should be divided, to facilitate coaptation, and to secure greater freedom from displacement and jerking; but in many cases this proceeding is unnecessary, and it certainly is unadvisable if it can be avoided. During the after treatment the greatest care must be taken to preserve the limb at perfect rest, and to prevent displacement, especially bowing outwards, to which there is often a tendency. To guard against this occurrence, it is advisable in many cases to keep a long splint applied to the side of the trunk, thigh, leg, and foot. The extremity thus put up may be laid on a mattress, or suspended by Salter's apparatus. The object aimed at, by local and constitutional treatment, should be to secure osseous anchylosis, or fibrous union, admitting of some slight degree of motion.

The cases for which this operation is suitable, are those of disease or injury which would otherwise be submitted to amputation, and in which the portions of diseased bone requiring removal are not great; where there is not very extensive disease of soft parts; and where the patient's constitution is such as to make the exudation of healthy material of repair a likely event, provided proper hygienic rules be observed.

History and Results.—From 1762, when Filkin first performed excision of the knee-joint, until 1830, this operation was performed in 19 cases, and of these 8 recovered and 11 died. For twenty years this operation was abandoned and universally condemned. Mr. Fergueson revived the operation in 1850, and it was early practised and advocated by Jones, Page, Mackenzie, Butcher, Holt, H. Smith, Humphry, Pritchard, and more recently by many surgeons. Of 184 cases in all, collected by Butcher and by Price, the mortality amounts to 21·2 per cent., which is less than that of amputation of the thigh; and in nearly 50 per cent. the result is said to have been a useful limb. There can be no doubt whatever that the result of this operation has already been of the greatest advantage; that great praise is due to Mr. Fergueson and the other distinguished surgeons who made us acquainted with its merits; and that the gratifying result in very many cases has been a most serviceable limb: but it is equally certain that, before we can arrive at perfectly accurate knowledge of the merits of this operation, it would be necessary to have minute information of the condition of the limb, in all cases, several months after operation; for there is reason to believe that, in some instances where the patients recovered, to use the words of a friend of mine, "the knee turned out so well, that the limb was quite useless."

Excision of the Ankle-joint was first performed by the elder Moreau in 1792; but the operation has never, in my opinion, met with the favour it deserves, and less care has been bestowed on its improvement than on many, no doubt owing to the very gratifying results of amputation at the ankle-joint. From frequent performance of this operation on the dead body, and once on the living, my decided impression is, that the operation can be best performed by making a semilunar incision on the outer side, raising up the flap, cutting off the under extremity of the fibula, opening the joint, bending the foot inwards, and cutting the bones with the pliers.

Excision of different Bones.—The scapula has been excised in whole or in part by Syme, Fergueson, Liston, South, and others; the clavicle in whole or in part by Mott, Travers, Davie, and lately, in a remarkable case, by Syme; the whole of the ulna has been excised by Carnochan of New York, and Jones, and the half of it near the wrist by myself; the whole of the radius has been removed by Butts of Virginia, and almost the whole of it by Erichsen. It could answer no useful purpose to describe these operations, as the mode of procedure must always be modified according to the extent and relations of the part to be removed.

CHAPTER XXIII.

DELIGATION OF ARTERIES.

THE deligation of an artery is performed in order to obliterate its canal, and stop its circulation at that point; to arrest hemorrhage from itself, or from some of its ramifications, when wounded or otherwise laid open; or to divert the chief current of blood from a diseased portion of the same trunk, or of one of its branches, as in the operation for aneurism. If the object be to arrest hemorrhage, the vessel is, when possible, exposed at the seat of injury; and two ligatures are applied, one above, and the other below the point of lesion. Deligation of the main trunk on the cardiac aspect of the injury would suspend the flow of blood from the proximal orifice of a divided artery, though probably not from the distal, or from a puncture in an artery not completely cut through, owing to the free anastomosis supplying blood to the main channel at some little distance below the point at which circulation has been arrested by the ligature. This is especially the case in the arteries of the extremities, the ramifications of which form very numerous inosculations. The only safe rule of practice, therefore, is to accomplish deligation both above and below the seat of injury.

When the object is to suspend or weaken the current through an aneurism, the vessel is to be exposed, and the ligature applied at some spot on the cardiac aspect of the lesion, but not so near as to endanger the deligation of a diseased portion of the vessel, or, on the other hand, so distant from it as to permit the collateral circulation to supply blood to the aneurism, except in very much diminished quantity. The ligature must also be applied at a point where no large branch proceeds from the vessel either above or below; so that space may be allowed for the formation of an efficient coagulum. It must be small, round, smooth, and firm, so as to effect clean division of the inner and middle coats of the artery, yet without laceration of the external tunic; and it must be strong, so that it may be pulled tightly without breaking.

When an artery is completely divided in a wound, each extremity is to be seized by the spring forceps or tenaculum, and drawn out, isolated from the surrounding tissues, to a sufficient extent to permit the ligature to be cast round it. At the same time, care is to be taken to exclude veins and nerves, as also portions of muscular tissue, which would prevent the ligature from embracing the arterial tunics with accuracy, or from effecting the necessary division of their inner layers ; while they would, by speedy absorption or sloughing, relax the noose, endanger its slipping, and so give rise to secondary hemorrhage. The ligature is always to be tied with precision in the form commonly called the reef-knot, which is drawn as tightly as possible, there being no danger of dividing the cellular coat of the vessel.

For tying an artery in its continuity, the instruments generally required are, two or three sharp scalpels of different sizes ; a pair of good dissecting forceps ; two or three flexible copper spatulæ, about an inch in breadth ; and an aneurismal needle, of curve varying according to the vessel requiring operation, and provided with a small round aperture near its point, just large enough to transmit the ligature, with which it is to be armed before commencing the operation. The point of this needle must be so far blunt as to be in no danger of piercing the arterial or venous coats, yet not to such a degree as to require much force to send it through the lax cellular tissue surrounding them. There should be spare silk at hand, a few suture needles, and isinglass plaster, besides the usual accompaniments of surgical operations—sponges, lint, and water. It is proper also to have a pair of spring forceps, lest any small vessel be divided during the dissection. It is better to avoid the use of the director in the division of the layers, as this instrument always causes more or less bruising of the parts.

The patient is placed in a position suitable for deligation of the particular artery. During the first incision, the posture should be so managed as to make the skin somewhat tense in the proposed line of wound, as this facilitates the perception of the guides to the vessel, and permits a smooth division of the integuments. Subsequently, however, relaxation is advisable, in order to allow of nerves and veins being drawn aside, and to facilitate the easy passage of the needle. The guides to the artery are examined, and its course is traced by its pulsation, when this is perceptible on the surface. An incision of ample length is then made over the vessel, nearly in a line with its course, so as to obtain the full room afforded by the length of the wound ; but sometimes a slight obliquity of direction is useful in facilitating the discovery of an intermuscular space, when the dissection is to be prosecuted deeply. The knife should not cut more than the integument and subcutaneous cellular tissue at this first stroke, whether the artery be deep or superficial. In the latter case, a slight excess in depth might lead to wounding the vessel ; and in the former, muscular fibres might be cut, the blood from which would obscure the farther dissection. Superficial veins and nerves are avoided in this incision, when their course is seen or known. The margins of the cutaneous wound are drawn in apart, and the deep fascia divided along the yellow line marking the muscular interspace, when this is the farther course of the dissection; or it is cautiously pinched up with a dissecting forceps, and divided in the requisite direction and extent by the surgeon lateralizing the cutting edge of the knife towards himself, when the vessel is superficial.

This motion of the knife is by far the safest; and when other things permit, the operator should stand on that side of the patient, which will enable him to lateralize the knife at the same time, away from the chief vein or nerve that is most in danger of injury. By thus keeping as much as possible the flat surface of the knife directed to the artery, and its back towards the vein or nerve, any accidental slip will be less apt to injure either. In deep dissections, the sides of the wound are kept apart by the copper retractors, bent to the required form. These take up much less room than the fingers of an assistant, and by exerting pressure assist in preventing venous oozing. Veins are avoided or drawn aside if necessary, as, when wounded, the blood which they furnish seriously obscures the most delicate part of the operation.

As the dissection deepens, a sponge or piece of lint is employed to remove any blood which interferes with a distinct view of the parts, and nerves are gently drawn aside when in the way. The sheath of the vessels being at last reached, is pinched up and opened in the same cautious manner as already described, to the extent of half an inch in front and over the artery rather than over the vein, which, if large, might overlap and obscure the former. Any loose cellular tissue now found covering the artery must be directed by the gentle touches of the scalpel, until the coats of the vessels are seen distinct and white, and sufficiently exposed in front, to permit the insinuation of the point of the aneurismal needle between them and surrounding objects; while all farther separation or disturbance is effected merely by the track of the needle in making its way round. The artery is by no means to be exposed to a greater extent than this, and must not be rudely lifted up in passing the armed needle. The point of this instrument should be entered on that side of the artery on which there is the greater risk of including nerve or vein; because at first it can be applied close to the artery with greater exactness than can perhaps be maintained during the rest of its course. Being applied at the proper side, and in close contact with the vessel, the point is insinuated between it and the adjacent object, with a gentle lateral motion of the handle, and is afterwards carried round by making the free extremity of the latter describe part of a circle, of which the artery represents the centre. When the point of the needle, having completed the circuit, is felt by the finger to be partially covered with cellular substance, the latter is to be cleared off by a touch with the nail or scalpel. The point being brought into view, the loop of the ligature is then seized with the forceps, drawn through a little and detained, while the needle is gently withdrawn; after which the loop is cut, and one portion of the ligature removed. The single thread now remaining is tied as firmly as possible in the reef-knot. One end being allowed to remain, it is brought out at the most convenient part of the wound, which is to be drawn together, secured by isinglass plaster or suture, and treated for adhesion. A piece of plaster should be applied over the extremity of the ligature which hangs from the wound, so as to prevent its catching anything that might endanger its forcible withdrawal.

Throughout the whole operation, the utmost delicacy of manipulation is requisite; and peculiarly so while exposing the vessel and passing the aneurismal needle. The chief dangers to be avoided in the deligation of an artery are, its undue exposure and separation from its connexions laterally and posteriorly,—treatment which would ensure sloughing of that portion, and consequent secondary hemorrhage; the wounding of veins, which accident would cause troublesome hemorrhage, and possibly induce phlebitis, or in some veins of the neck and axilla might cause instant death by giving entrance to air; and, lastly, the including of a vein or nerve in the ligature, a circumstance which, happening to one nerve at least, the pneumogastric, would, if not discovered and corrected, speedily prove fatal; as indeed has been known to occur. The ligature becomes loose by absorption, ulceration, or sloughing of the portion of arterial tunic within its noose, in a period varying from ten to twenty or even thirty days. At the expiry of the third week, it may be gently touched, when, if loose, it will come away immediately; but if the slightest resistance is felt, no force must be employed. In a few days it may again be tried, as, when left to itself, it frequently remains a considerable time in the wound after its complete detachment, delaying thereby the complete healing of the wound, and protracting the period of anxiety as to its safe separation naturally experienced both by surgeon and patient.

DELIGATION OF THE AORTA.

Sir A. Cooper, James of Exeter, Murray at the Cape of Good Hope, Monteiro at Rio Janeiro, and South of London, are the five surgeons who have dared to tie the aorta. Sir A. Cooper was the first to conceive the idea of the arrest of this greatchannel of circulation being compatible with life, and he was the first who had the determination to perform the operation. His operation, and that of James, consisted in dividing a part of the anterior wall of the abdomen on the left side of the umbilicus, turning aside the intestines, and dividing the peritoneum in front of the aorta. The other three surgeons made an incision six inches in length on the left side, from the tenth rib to the anterior superior spinous process of the ilium, cut through the parts down to the peritoneum, and reached the aorta by pressing the peritoneum forward. The results were—Sir A. Cooper's patient lived 40 hours; James's died speedily; Murray's lived 23 hours; Monteiro's lived till the 10th day; and South's, 43 hours.

DELIGATION OF THE ARTERIA INNOMINATA.

This artery has been tied 9 times in all; in the great majority of the cases on account of subclavian aneurism. The operators were Mott, Graefe, Hall, Dupuytren, Norman, Bland, Lizars, Hutin, and Arendt. All the patients died. In 4 of the cases, death was caused by secondary hemorrhage; in 2, by inflammation of the lungs; and in 3, the cause of death is not mentioned. In 4 other cases, the operation was attempted by surgeons of the highest talent, but abandoned on account of insuperable difficulties.

DELIGATION OF THE SUBCLAVIAN IN ITS FIRST DIVISION.

The subclavian has been ligatured on the tracheal side of the anterior scalenus seven times. The operators were Colles, Mott, Hayden, O'Reilly, Partridge, and Liston, who performed the operation twice. All the patients died—6 from hemorrhage, and 1 from pericarditis and pleurisy.

In the present state of our knowledge, it appears very clear that deligation of the aorta, the arteria innominata, and the subclavian on the tracheal side of the anterior scalenus should no longer hold a place among the justifiable proceedings in surgery.

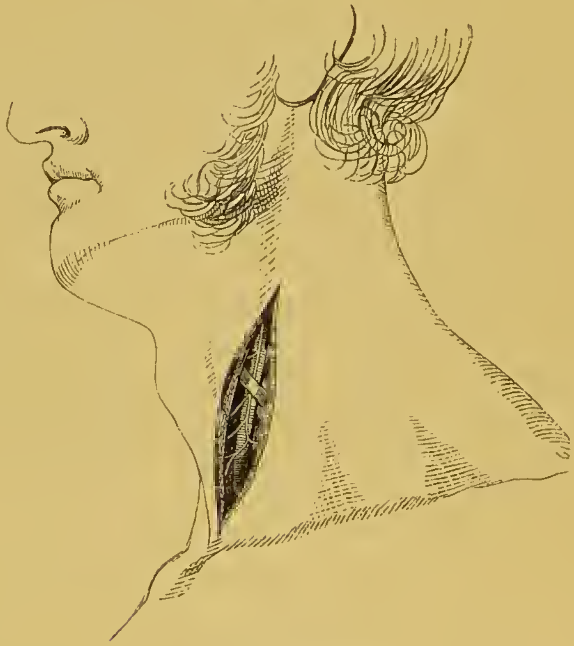
DELIGATION OF THE COMMON CAROTID ARTERY.

The common carotid may be tied above or below where the artery is crossed in front by the omohyoid muscle.

In the first-mentioned situation, deligation of the common carotid is termed the superior operation. It may be required for wound or aneurism of any of its branches, and may be performed in the following manner:—

The patient being placed on his back, with the chest a little raised, a small cushion under the nape of the neck, so as to make it prominent in front, and the head thrown well back, with the face thrown to the opposite side from that on which the artery is to be tied, an incision is made from the part nearly opposite the angle of the jaw, to a little below the level of the cricoid cartilage, along the inner border of the sterno-mastoid muscle, which forms the guide to the vessel, and of which the course corresponds with a line drawn from the sternal extremity of the clavicle in the direction of the mastoid process. The skin, subcutaneous, cellular, and adipose tissue, the platysma myoides, and the layer of cellular tissue beneath being successively divided, the head is then turned a little, so as to relax the parts about the wound, and permit its edges to be drawn apart, any superficial veins being at the same time drawn aside. The deep fascia is now to be pinched up with a forceps, and cut in the cautious manner formerly described; which being done, the sheath of the vessels will be found in the angle formed by the sterno-mastoid and omohyoid muscles.

Fig. 253.



From Liston.

The descendens noni nerve, or some of its branches, will be seen in this stage, and must be carefully guarded from injury. The sheath appears of a dark colour towards its outer part, where it covers the vein, but of a lighter hue on its inner aspect, where it conceals the artery; and is occasionally pierced by a vein from the thyroid body which runs across the carotid artery about the middle of the neck, to enter the internal jugular. This vein, when present, must not be cut, as it would yield much blood, and obscure the farther progress of the dissection in its most delicate stage. The sheath is opened to the extent of half an inch towards its tracheal side—that is, over the artery rather than the vein, so as to confine the latter, which, being very large, slightly overlaps the former, especially in expiration, when it becomes very turgid. The proper mode of opening it is, as before explained, by pinching it up with a forceps, and cutting horizontally as in opening a hernial sac. If this vein bulge so much as inconveniently to cover the artery, a finger may be pressed over it in the upper part of the incision, with the effect of diminishing the quantity of descending blood. The artery is the most internal of the three objects within the sheath, the vein being the most external; while the pneumogastric nerve lies between the two vessels, and rather behind them. The artery being now sufficiently exposed in front, a slightly curved aneurismal needle armed with ligature is passed round it, from without inwards, so as to preserve the vein and nerve from injury, and the latter from being included by the thread. The operation is then finished according to the general rules previously laid down.

When we wish to secure the primitive carotid, whether on account of the existence either of aneurism or wound of its branches, the superior operation is to be preferred, on account of the comparatively superficial situation of the vessel; but when the aneurism occupies the trunk, we are obliged to place the ligature below, where the artery is crossed by the omohyoid muscle; in which case the operation is called the inferior, and is more easily performed on the right side than on the left: but it is likewise more dangerous, because the proximity of the subclavian will increase the difficulty of the formation of the internal coagulum in the origin of the carotid. The first incision should be about three inches in length, commencing immediately above where the artery is crossed by the omohyoid, and extending along the course of the vessel. After cutting through the skin, subcutaneous, cellular, and adipose tissue, the platysma myoides, and the cellular tissue beneath, the sterno-mastoid is to be drawn backwards, and the sterno-hyoid and sterno-thyroid forwards, when the deep cervical fascia is brought into view; after which the remaining steps are to be proceeded with as in the superior operation.

Dr. Norris has published the results in 149 instances in which the carotid was ligatured. Of these cases, 32 proved fatal; and in 18, death was caused by cerebral disease. Among the causes of death, cerebral disease holds the highest place, and the next cause in point of frequency was low congestive pneumonia, which is believed, and no doubt correctly, to be produced through the intervention of an impression produced upon the brain. In a case in which I tied the common carotid, death eventually took place in consequence of pneumonia; but the affection of the lungs was preceded by symptoms of great cerebral disturbance.

DELIGATION OF THE SUBCLAVIAN ARTERY.

The operation of tying the subclavian artery on the acromial side of the anterior scalenus muscle may be required in aneurism of the axillary artery, and may be performed in the following manner:—The patient being placed in the recumbent posture, with the shoulder depressed as much as possible, the head slightly inclined to the opposite side, and the integument in front of the chest drawn down by an assistant, the surgeon divides the skin upon the clavicle, from the acromial border of the sterno-mastoid muscle to the clavicular attachment of the trapezius. On the hands of the assistant being removed, the wound rises above the clavicle, becoming parallel to it in the under region of the neck. The platysma myoides and fascia should then be cautiously divided, care being taken after division of that muscle not to injure the external jugular vein, which passes down under the muscle near the middle of the incision. On dividing the cellular tissue along its inner border, the vein can, in general, be easily kept out of danger, by being gently drawn to the acromial aspect of the wound by means of a copper spatula. The various tissues having been divided, from the acromial margin of the sterno-mastoid to the inner border of the omohyoid muscle, the cellular tissue covering the small triangle formed by the two scaleni muscles and a portion of the first rib should next be divided, and the suprascapular artery held towards the scapula by another copper spatula. The acromial border of the anterior scalenus muscle should be exposed; and on tracing it down to the first rib, the artery will be found in the angle formed by that margin of the muscle and the first rib, lying internal and inferior to the lower fasciculus of the brachial plexus. The ligature is then passed underneath the artery by an aneurismal needle; and, in doing so, the preferable proceeding is, to direct the convexity of the instrument towards the clavicle, to apply its point close to the artery, and to carry it round in such a way as not to disturb the artery, except above, to a greater extent than is produced by the track of the needle. When the ligature cannot be drawn by the fingers pressed down on the vessel, it may be run close by means of a notched probe. The principal risks to be guarded against in performing this operation are,—wounding the external jugular vein, the suprascapular artery, and the subclavian vein; detaching the artery from its surrounding connexions to an undue extent; or mistaking a fasciculus belonging to the brachial plexus for the artery. In connexion with this operation, it should be borne in mind, that a large communicating branch sometimes runs superficially to the clavicle between the cephalic and external jugular veins, which, when present, would probably be divided in the first incision. The sterno-mastoid and trapezius muscles are occasionally attached to a much greater length of the clavicle than usual, and in such a case their fibres to some extent must necessarily be divided, in order to obtain an external wound affording sufficient freedom. The omohyoideus also has been known to contract an additional attachment to the clavicle near its scapular extremity.

On the 26th of December, 1857, I was requested by my colleague, Professor Ogston, to visit a patient, who, three days previously, had applied to him for advice, in consequence of having a swelling, which the Professor believed to be caused by a large axillary aneurism.

The patient's history of his case was, that he had felt uneasiness in front of his left shoulder for several months; that on the 12th of November the parts in that region were suddenly and violently strained; that on the 26th, while in the discharge of his duty as a criminal officer, and endeavouring to secure a prisoner, he was in a severe struggle violently dashed upon the ground; that he felt excruciating pain in his armpit while falling, and when he fell, received on the front of his shoulder the whole weight of the person he was attempting to secure; that he became quite sick from the violence of the pain; that he was unable to move his arm for three or four days, and very soon discovered swelling and pulsation in his armpit.

I found the patient to be a man of sanguine temperament, about fifty-one years of age, whose habit of body was full, approaching to obesity, and his neck short and thick. The swelling was of an oval form, pretty distinctly circumscribed, and extended from the axilla to near the clavicle, which was considerably pushed upwards, and could not be pressed downwards without causing uneasiness. By extending both downwards and forwards, the swelling had caused the hollow in the axilla to disappear, and its anterior fold to rise forwards. The swelling was slightly compressible; it had a whizzing bruit, and pulsation of a distensile, eccentric, and expanding character, which raised the hand, when laid upon any part of the tumour, by a distinct impulse from within. The pulsations were arrested by pressure upon the subclavian artery, which, however, caused great pain; and it was evident that the moment the pressure was removed, the swelling suddenly became enlarged.

Professor Ogston and I agreed that a most careful examination of the chest and abdomen should be made; and, in the event of discovering no signs of a second aneurism, the patient should, for a few days, be put upon a somewhat restricted diet, and enjoined the use of some mild saline aperient; after which, a ligature should be placed upon the subclavian artery, where it passes over the first rib. The very plethoric appearance of the patient seemed to indicate the propriety of this treatment, before proceeding to tie the subclavian artery; and this was instituted for one week previous to the 4th of January, on which day, with the assistance of my two colleagues, Professors Ogston and Lizars, I tied the subclavian, Professor Ogston taking the whole charge of the administration of chloroform, and Professor Lizars assisting in the manipulation in the operation.

The operation being on the left side, the clavicle being pushed upwards, the patient being of a full habit of body, and the neck being very short, all tended to increase the depth of the vessel at the point of deligation; but, notwithstanding its great depth, the artery was exposed, without any difficulty, and a common aneurism-needle placed under it,—every part having been most distinctly visible which it was desirable to see; and, what is also very satisfactory in such an operation, no part was brought into view which it was undesirable to see. The instant the ligature was drawn tightly, my two colleagues simultaneously pronounced the pulsation stopt in the aneurism. When the outer edge of the anterior scalenus muscle was exposed, the inner portion of the brachial plexus was brought into view; but, as the muscle was seen proceeding farther downwards, there was no danger in this instance, of mistaking that portion of the plexus for the artery, even before using the finger to feel for the tubercle of the first rib. The patient continued as well as could be desired, until the morning of the fourth day after the operation, when he was observed to be slightly confused. On the succeeding night, he became exceedingly so—slept none—required two attendants to keep him in bed, and, notwithstanding their efforts to prevent him, he tore the dressings from the wound; but, fortunately, did not get hold of the ligature. On the morning of the fifth day he was still sleepless, restless, and agitated—expressed himself as anxious to escape from strangers and enemies he fancied to be in his room—his thoughts were troubled—he looked suspiciously to the back of his bed—his skin was damp—his pulse soft, and his tongue moist and creamy. This assemblage of symptoms led to a most searching inquiry into the patient's history; and from the members of his family, it was learned that, two years previously, he was addicted to intoxication, and that, until ten days before the operation, he always had a glassful of whisky every morning, which they called his morning dram, and two, or perhaps three, in the course of the day. Professor Ogston and I then advised that he should have a wineglassful of whisky, morning, noon, and evening, as well as strong beef-tea several times a-day. We had the satisfaction of finding that he slept well next night; and, without any other treatment whatever, every unpleasant symptom has disappeared, and since, the patient has gone on as favourably as possible. It was only when symptoms of a very alarming character presented themselves that it was possible to arrive at a correct knowledge of the patient's habits; and the discovery filled my mind with the greatest possible apprehension of fatal hemorrhage at the period of the separation of the ligature. In the above-described circumstances, I scarcely dared to hope for the desired action going on at the deligated portion of the artery. The ligature, however, came away on the seventeenth day after the operation without hemorrhage, and none has ever occurred. It is now three weeks since the ligature came away, and the wound is perfectly cicatrized. There never has been any return of pulsation in the aneurism, which is now consolidated, as well as considerably reduced in size. This case may therefore be added to the list of successful instances of tying the subclavian artery.

Facility in the performance of this operation is greatly promoted by a free external incision, and safety by having the deep portion of the wound as circumscribed as compatible with the distinct application of the point of the aneurism-needle to the outer coat of a very limited portion of the artery. Except at the point of application, the artery should be disturbed only to the extent unavoidable by the track of the needle. In all deligations of vessels it is absolutely necessary, that the separation from surrounding connexions should be as small as possible, so as to diminish the risk of hemorrhage; but in this operation, it is important in order to lessen the risk of inflammation in the chest, the seat of which is the pleura or pericardium, or both—a more frequent cause of death than even hemorrhage after tying the subclavian. The cellular tissue surrounding the artery is the structure between it and the upper part of the pleura, and the less this is disturbed, the less will be the danger of inflammation arising in it and spreading from it to the pleura. This case is the 48th of recorded examples of this operation; and the importance of the view just stated must be evident, when it is mentioned that 24 of the patients lived and 24 died, and that the principal causes of death were, in the order of frequency, inflammation within the chest, suppuration in the aneurismal sac, and hemorrhage. The above report was published in the "Edinburgh Medical Journal" of March, 1858.

Upwards of nineteen months after I operated on this man, he suddenly fell down dead while on duty at a review. By the kindness of Professor Ogston I was present at the post-mortem examination, and saw that the cause of death was the bursting of an aortic aneurism into the left pleura. The subclavian and axillary arteries were converted into an exceeding small impervious tissue, from the first branch given off by the subclavian on the cardiac side of the point of deligation, to where the axillary gives off the posterior circumflex artery of the humerus. At the part where the subclavian was tied, the two portions of the impervious cord were separated from each other about the third part of an inch, the interval between them being filled up by cellular tissues, by which both ends were surrounded. The only trace of the large aneurism was a small fibrinous hard body, about half the size of the last phalanx of the fore-finger. I showed the preparation to my colleagues at the Aberdeen Hospital, and they all considered it one of great interest.

DELIGATION OF THE AXILLARY ARTERY.

The axillary artery may be tied with great facility in its lower third, below the origin of its subscapular and circumflex branches, when the arm is abducted and rotated outwards very much, in which position the anterior fold of the axilla is removed from the vessel. The fore-arm should be kept supinated and slightly bent, so as to prevent painful tension of the nerves. The guide to the artery here is the inner margin of the coraco-brachialis muscle; and the pulsations can also be easily felt. An incision, about three inches long, is made in the direction indicated, cutting through the tense integument and the subcutaneous cellular tissue. Then the deep fascia being completely divided, the median nerve is exposed, lying in front of the artery. The arm may now be lowered somewhat, so as to relax the parts, and permit the median nerve to be drawn aside, and facilitate the easy passage of the aneurismal needle round the artery. This is effected from within outwards, in order to secure from injury the axillary vein, which lies internal and anterior to the artery, as well as the internal cutaneous and ulnar nerves, which lie on its inner aspect. The radial nerve is behind, but in little danger. It must be remembered that the humeral veins sometimes run up for some distance in the axilla, before they unite to form the axillary; and also, that the artery sometimes divides in the same space into two branches, which afterwards become the radial and ulnar.

DELIGATION OF THE HUMERAL ARTERY.

The humeral or brachial artery may be tied in any part of its course. The arm is to be abducted, and sufficiently rotated outwards, while the fore-arm is supinated, and, after the first incision, slightly flexed. The guide to the vessel, in the upper portion of its course, is the inner margin of the coraco-brachialis; in the middle and lower parts, that of biceps; and in the lower portion of the arm, that of the tendon of the last muscle. In the former situations, the external incision should be about three inches in length; in the latter, it may be somewhat shorter. The integument and superficial fascia are first cut through; after which the deep aponeurosis is cautiously divided, the basilic vein being drawn inwards and out of danger. The internal cutaneous nerve in the upper part of its course lies near the line of incision, but in the lower, becomes internal to the vessel, and the deep brachial veins embrace the artery laterally, and frequently communicate by cross branches which pass in front or behind. These communicating twigs are to be avoided. The occasional high division of the brachial artery must be remembered. When this occurs, the two vessels run side by side, and are evidently much smaller than the single trunk usually present. Before finally tightening the ligature, it is necessary to observe, by the effect of compression, which vessel is chiefly implicated in the disease. Probably both will require deligation. It is worthy of remark, that of the two vessels, the one which afterwards becomes the ulnar furnishes nearly all the regular branches normally distributed by the humeral artery.

DELIGATION OF THE RADIAL AND ULNAR ARTERIES.

The radial artery may be tied on the anterior aspect of the fore-arm, by making an incision from two to three inches in length, carried along the inner margin of the supinator radii longus in the upper portion; but in the lower part, along the outer edge of the tendon of the flexor carpi radialis, which can here be more distinctly traced than that of the former muscle. The course of the artery in this region corresponds with a line drawn from midway between the condyles of the humerus, obliquely downwards and outwards, to a point a little internal to the styloid process of the radius. After cutting through the skin, and the superficial and deep fascia, the artery is found accompanied by venæ comites. In the middle third of the arm, a nerve—the radial branch of the musculo-spiral, or, according to a different nomenclature, the dorsal cutaneous branch of the radial nerve—lies at a little distance on the radial side of the vessel; but it is scarcely in the way of the needle; and elsewhere it is still farther removed. The radial artery may also be tied on the dorsum of the hand, before it dips into the space between the first and second metacarpal bones on its way to the palm. The incision is made along the extensor tendon of the extreme phalanx of the thumb, either on its radial or ulnar aspect, according as the thumb is approximated to, or abducted from the index finger. The skin, cellular tissue, and a delicate dorsal fascia are divided, along with some minute nervous and venous twigs. The ulnar artery may be tied in the middle and lower thirds of the fore-arm, or at the wrist. In the lower third, it is easily exposed by an incision of two or three inches in length, carried along the radial border of the tendon of the flexor carpi ulnaris, through the skin and the superficial and the deep aponeurosis. The artery is found lying close on the radial side of the tendon, and rather deeper. The ulnar nerve is here applied rather closely on the ulnar aspect of the vessel, and is accordingly to be avoided by passing the needle between them from the ulnar towards the radial side. The venæ comites are at the same time to be preserved from injury. In the middle third, the artery is rather deeply situated, but may be reached by a free incision, guided by tracing up the tendon of the flexor carpi ulnaris, on the radial side of which muscle the division of the integument, fascia, and deep aponeurosis is to be effected. The artery is exposed between the muscle already named and the superficial flexor of the fingers. Here also the ulnar nerve is found on the ulnar side of the vessel. At the wrist, this artery may be tied, after dividing for about two inches the integument and fascia along the radial side of the pisiform bone and the tendon of the ulnar flexor, in which situation the vessel is found, having the nerve still related to its inner side.

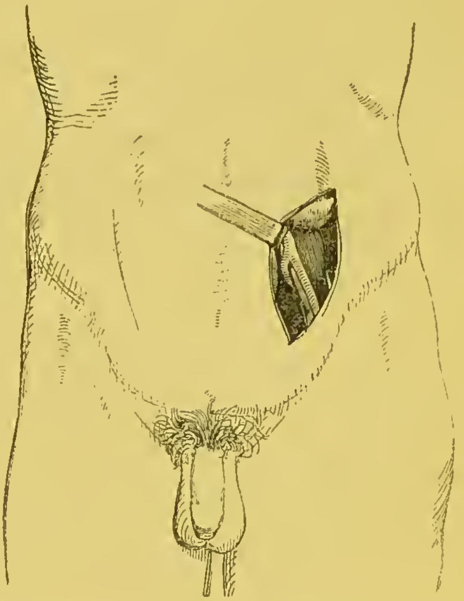
THE EXTERNAL ILIAC ARTERY.

The external iliac artery is secured in the following manner:—The patient is placed with his shoulders well raised and the thighs slightly flexed, so as moderately to relax the abdominal parietes. An incision from four to five inches long, but varying in length according to the corpulence of the individual, is commenced a little above the centre of Poupart's ligament, and carried upwards with a slight inclination outwards, so as nearly to correspond with the course of the fibres of the tendon of the external oblique muscle, named by many the anterior layer of the abdominal aponeurosis. In this first incision the integument and superficial fascia are divided. The aponeurotic fibres just mentioned are separated along the line of wound with as little cross-cutting as possible. The fibres of the internal oblique and transversalis muscles are next divided very cautiously, employing the forceps when necessary. The part of the transversalis fascia, which at the internal aperture of the inguinal canal is thinned, and sends off a tubular prolongation downwards over the spermatic cord, is pinched up at this spot, and opened immediately externally to the cord with great caution, so as not to wound the peritoneum which lies directly behind. The finger is now inserted into the aperture thus made in the transversalis fascia, and gently insinuated between it and the peritoneum, with which guard against wounding that membrane, the fascia is divided, like the other layers, upwards and outwards to the same extent. During the progress of the operation, the margins of the wound are to be kept well apart by means of bent copper spatulæ. The peritoneum is then detached at the lower and outer aspect of the wound, and as far as requisite, from the iliac fascia, by gently insinuating the fingers and opening up its delicate cellular connexions, which at this part are remarkably loose. The inner margin of the wound and the peritoneal sac are now drawn inwards so as to expose the vessels. The artery is separated from the vein, which lies on its inner and posterior aspect, by a scratch with the point of the scalpel, and that sufficiently to permit the introduction of the point of the aneurismal needle between them, at some little distance above the origin of the deep epigastric artery, the instrument being carried from within outwards. When, owing to the thickness of the abdominal parietes and the consequent depth of the artery, it is impossible to encircle it with the common needle, or to tighten the knot by pressing the fingers down on each entwinement, then Weiss's aneurismal needle and the notched probe may be employed to accomplish these ends. After operation, the parts are replaced, the wound being maintained in apposition by a few sutures, while the limbs are still farther raised, so as to relax the abdominal parietes and the deligated vessel.

Since Abernethy performed this operation in 1796, it has been performed 100 times on account of inguinal aneurism. In some of the cases, there were two aneurisms, but in 92 there was aneurism only in the groin; and of these, 70 were cured, and 22 died. Death resulted in 8 cases from gangrene of the limb; in 4, from secondary hemorrhage; in 3, from tetanus; and in 3, from causes of a general nature. It will thus be seen that, among the causes of death, gangrene of the limb holds the highest place; and pressure upon the vein is believed to be the cause of the frequent occurrence of gangrene.

THE COMMON ILIAC ARTERY.

Fig. 254.



The common iliac artery is reached by proceeding in the same way as above described for the external iliac. This vessel is traced up until the primitive trunk is discovered. The external incision must, however, be longer, varying from five to six inches; and the peritoneum requires detachment to a greater extent upwards and inwards. The ureter crosses in front of this vessel, near its bifurcation, but is usually raised up along with the peritoneum; if not, it must be avoided. It should also be remembered, that while the vein of each side lies posterior to its corresponding artery, the vein of the right side inclines also a little to the outer aspect, and that of the left to the inner aspect of the vessel which may require deligation. Of 17 patients on whom this operation was performed, 9 recovered, and 8 died. In 4 of the fatal cases, the magnitude of the disease was the chief cause of death; in 2, the peritoneum was opened previous to operation, which no doubt added to the danger of it; and in no instance did gangrene of the limb occur.

THE INTERNAL ILIAC ARTERY.

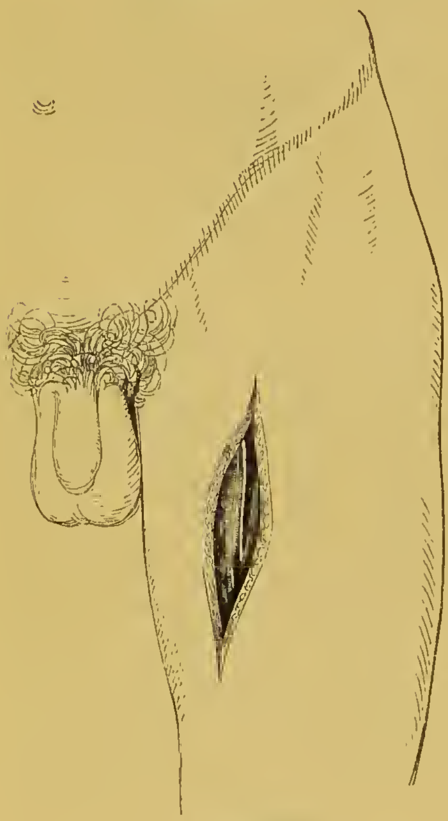
The internal iliac artery may be tied by a similar proceeding to that for the common iliac. It will be found by tracing up the external iliac to the point at which the primitive vessel bifurcates on the sacro-iliac junction. The ureter crosses in front and the vein lies behind. The latter, however, on the right side is also a little external, and on the left it is somewhat internal to the artery. This vessel has been ligatured 7 times; 4 of the patients recovered, and 3 died.

DELIGATION OF THE COMMON FEMORAL ARTERY.

Deligation of the common femoral artery is a very easy, though not likely to be a very successful operation, on account of the proximity to the ligature of the origins of the epigastric and circumflex iliac vessels above, and that of the profunda femoris below. The artery emerges from beneath Poupart's ligament, midway between the anterior superior spine of the ilium and the spine of the pubes. Its pulsations, moreover, in the natural state of parts, are easily felt. The skin may be divided by an incision of two or three inches in length downwards from a little below Poupart's ligament. The saphena major vein being then drawn aside, if in the way, the loose cellular tissue and any glands present are carefully cut through. The fascia and proper sheath are then opened, and the point of the scalpel employed, if necessary, to scratch the cellular tissue between the vessels, and afford a commencement to the entrance of the aneurismal needle, which is carefully passed from within outwards, so as not to injure the vein which lies internal to the artery.

The fittest point at which to secure the femoral artery after it has given off the profunda, is, immediately before it runs beneath the sartorius in the angle formed by that muscle and the adductor longus. The vessel may usually be traced by its pulsation downwards and inwards from the centre of Poupart's ligament. The incision should pass over the angle formed by the sartorius and the adductor longus, should be directed downwards and a little inwards, be about three inches in length, and cut through the integument and superficial fascia. The fascia lata is pinched up by the dissecting forceps, and carefully divided, avoiding any twigs of the anterior crural nerve, which are here found in front of the artery as the incision deepens. Lastly, the sheath found in the angle mentioned above is opened with the usual caution for about half an inch.

Fig. 255.



From Liston.

The femoral artery and vein are much more intimately covered and connected together by cellular substance than any other vessels. Accordingly, the former must be cleared of this loose tissue for a minute space in front, till its external tissue is seen distinct and white, the forceps and point of the scalpel being employed in this delicate part of the operation. Then the aneurismal needle may be safely and easily passed round the vessel, from within outwards, the vein lying internal and posterior, and the nerve on the outer or iliac side. It must be remembered, that the femoral artery is, like the humeral, sometimes found double, and that deligation of one of the vessels would probably fail in producing the desired effect. The results of tying this vessel are stated in the chapter on Aneurism.

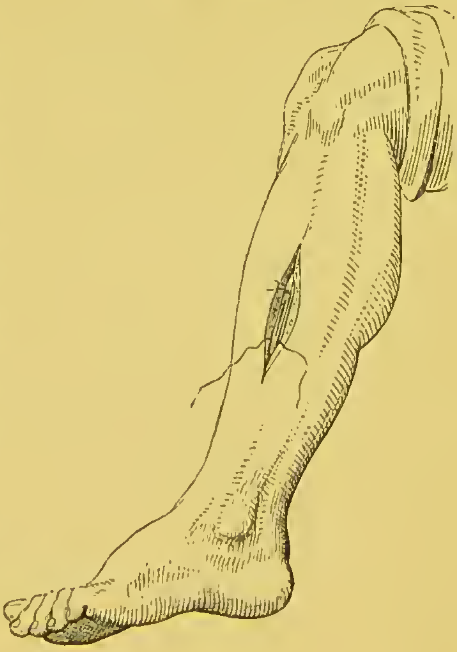
THE POPLITEAL ARTERY.

The popliteal artery is now very seldom made the subject of operation, though disease in it frequently necessitates deligation of the femoral. It may be secured by making an incision, about four inches in length, down the centre of the popliteal region, commencing in the upper part of this space, and cutting through the skin and superficial fascia. Subsequently the aponeurosis is divided, and the surgeon cautiously deepens the dissection along the outer margin of the semi-tendinosus and semi-membranosus muscles. The vessels are at last reached, lying in a quantity of cellular tissue; and when this is sufficiently cleared aside, the vein is discovered lying superficially to the artery. The former must be gently drawn aside, and the intimate cellular connexion between it and the artery being loosened at one point by a delicate touch with the point of the scalpel, the needle may be gently insinuated and passed around the latter, from within outwards, a little higher up than the plane of the knee-joint. The internal popliteal nerve, lying superficially to the artery, and towards its outer side in this part of the space, must, if exposed, be drawn out of danger. The popliteal vein has also a slightly external, as well as a posterior, relation to the artery.

THE ANTERIOR TIBIAL ARTERY.

The anterior tibial artery is easily reached in the lower third of the leg, by an incision, two or three inches in length, along the outer side of the tendon of the tibialis anticus, cutting through skin, superficial fascia, and the deep aponeurosis of the leg. The artery here lies on the outside of that tendon, between it and that of the extensor proprius pollicis, with the corresponding nerve in front, and a vena comes on either side. If the incision be made too far down, the tendon of the extensor proprius pollicis would be found crossing over in front of the artery, in immediate proximity to the ankle-joint.

Fig. 256.



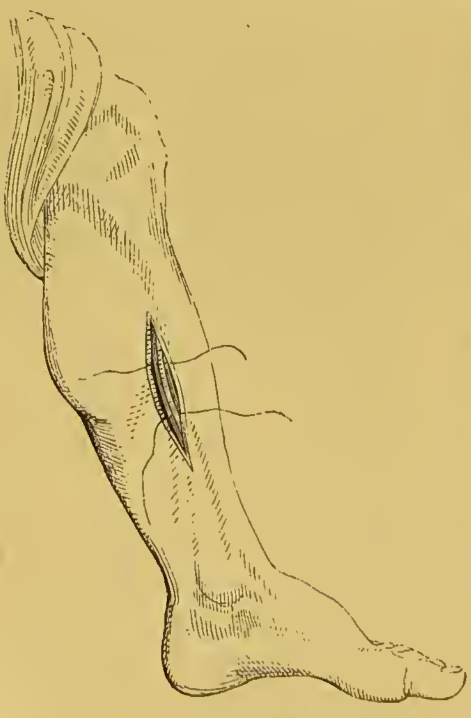
From Liston.

On the middle third of the leg,

this vessel lies deeper, and requires an incision of proportionate length, which is guided either by selecting the middle line between the crest of the tibia and the border of the fibula, or by tracing up the tendon of the tibialis anticus, along the outer margin of which muscle the division is to be effected. After separating this muscle from the extensor proprius pollicis, the artery is found between them, with its venæ comites placed as usual, and the anterior tibial nerve lying generally in front.

In the upper third of the leg, this artery lies very deep, being covered by the apposition of the tibialis anticus on its inner side, with the extensor longus digitorum on its outer aspect. The incision must be at least four inches in length; and is to be carried down in the central line, between the crest of the tibia and margin of the fibula. The skin and superficial fascia being divided, are drawn apart, and the muscular interspace is sought for by moving the foot, and so making the muscles start up; or it can generally be observed by a yellow line, marking the spot where the aponeurosis is thickened at the attachment of the intermuscular septum. Moreover, the cutaneous incision made in the course indicated corresponds almost exactly with this interspace. The deep fascia is then divided along this line, and the separation of the muscles effected by the handle of the scalpel, or, if necessary, by its edge also. The artery is at last found, with a vena comes on each side; and the nerve in this situation lying on its outer aspect. The aneurism-needle may then, with the usual precautions, be passed from the fibular to the tibial side.

Fig. 257.



From Liston.

DELIGATION OF THE POSTERIOR TIBIAL ARTERY.

The posterior tibial artery may be tied behind the inner ankle, when the foot is flexed and turned inwards, by making an incision midway between the internal malleolus and the tendo Achillis, curving gently forward at its lower part, and extending to two or three inches in length. The skin and superficial fascia are cut through, and subsequently the strong aponeurosis is divided, when the artery will be found, accompanied on either side by a vein, and by the posterior tibial nerve on its outer aspect towards the tendo Achillis. The tendon of the flexor proprius pollicis is also placed on the fibular aspect of the artery, and those of the flexor longus digitorum and tibialis posticus run on its tibial side, or near the inner ankle. The foot should be slightly extended, while the needle is being passed from the tibial to the fibular side, so as to relax the tissues and facilitate its transit.

In the middle of the leg, deligation may be effected by making a very free incision between the tibia and the margin of the gastrocnemius, which muscle is drawn aside. The soleus is next detached from its tibial origin, and is also pulled aside. Lastly, the deep layer of the tibial aponeurosis is divided, and the vessel reached, accompanied by its venæ comites and the nerve which, about the middle of the artery, lies superficially to the vessels. If deligation be required on account of a wound of the artery, the vessel must be tied above and below the seat of the injury.

DELIGATION OF THE DORSAL ARTERY.

The continuation of the anterior tibial artery on the dorsum of the foot, known as the dorsal artery, may be tied about the middle of its course, by making an incision through the skin, fascia, and aponeurosis, along the outer or fibular side of the tendon of the extensor proprius pollicis, where the artery will be found, with the innermost tendon of the extensor longus digitorum on its outside. A vein runs on either aspect as usual, and the continuation of the anterior tibial nerve runs externally and superficially to the artery.

CHAPTER XXIV.

AFFECTIONS OF THE RECTUM.

RECTITIS, OR INFLAMMATION OF THE RECTUM.

Causes.—Rectitis may be produced by extension of inflammation from neighbouring parts,—by external injury,—by hæmorrhoids in an inflamed state,—by alterations of temperature,—by foreign or irritating substances in the bowel,—or by operations performed on the rectum or near it. Sometimes, though very rarely, it occurs as an idiopathic disease.

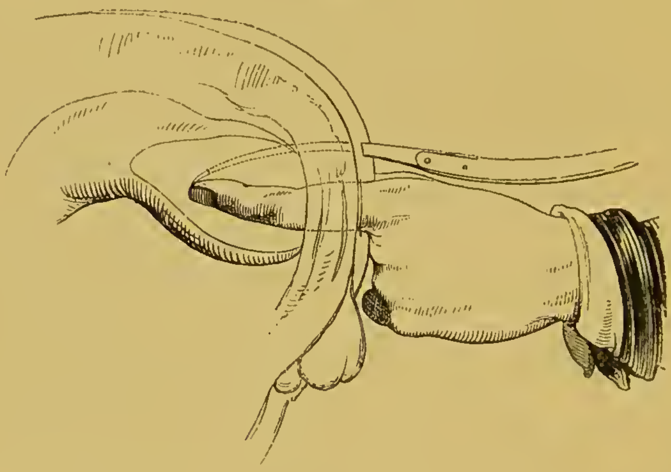
Symptoms.—In acute rectitis, in addition to the usual symptoms of very smart irritative fever, the patient experiences a sense of fulness and weight in the rectum, a bearing down, a distressing burning heat, and excruciating pain, aggravated to a most agonizing extent by tenesmus and contraction of the sphincter muscle. In many cases there is, after a short time, a scalding discharge of a muco-purulent matter, and in most instances the urinary organs sympathize, so that, in addition to the symptoms affecting the rectum, the patient is distressed with strangury, or painful micturition, or even with retention.

Treatment.—The treatment consists in removing, if possible, the cause of the disease, in confining the patient to the recumbent position, in enjoining the strict observance of the antiphlogistic regimen, in instituting local depletion by the application of leeches around the anus, in obviating constipation by the use of the mildest enemata, in the diligent and efficient employment of warm and emollient applications, and in allaying the tenesmus, contraction of the sphincter ani, pain of the rectum, and the distressing symptoms affecting the urinary organs, by the use of opiates, which may be applied to the rectum in the form of enema, or be suppositary, or diffused through ointment: in some instances it is necessary to give them by the mouth. Ulceration of the rectum, deposit of lymph between the coats—laying the foundation of stricture—perforation of the rectum by ulceration, extension of inflammation to the surrounding cellular tissue—producing abscess in the first instance and afterwards fistula —are some of the consequences of this painful affection when not speedily subdued; and in order to their prevention, the treatment should be as energetic as the circumstances of the case seem to justify.

FISTULA IN ANO.

When a fistula has an external and internal opening, it is said to be complete; when an external opening only, it is called a blind external, and when it has only an internal opening, a blind internal fistula; in the two latter cases the fistula is said to be incomplete. This affection is much more common in men than in women, and the period of life at which it most frequently occurs is between twenty and fifty years of age. The situation of the external opening is usually at the side of the anus, very rarely either before or behind; and with regard to the situation of the internal opening, M. Ribes found, on examining seventy-five bodies in which fistula existed, that in all cases in which there was an internal opening, it was not high up, but immediately within the sphincter muscle. This observation accords with the experience of Sabatier, Larrey, and many others. Before performing an operation for the cure of fistula, it is of the greatest importance to ascertain that the disease is entirely local, in which case the desired result will be obtained; whereas, if the disease be connected with pelvic abscess, or with disease of the sacrum, or with organic disease of the lungs, liver, or any other important internal organ, the surgeon will bring discredit on himself by recommending an operation. Sir A. Cooper remarks, "The surgeon often brings discredit upon himself by operating in these cases in the last stage of *phthisis;* and when it is impossible that the disease can be cured; therefore, that death, which is the result of pulmonary disease, is falsely attributed to the *fistula in ano.*" Sir B. Brodie observes, "In those cases in which a *fistula in ano* occurs in connexion with some organic disease of the lungs or liver, I advise you never to undertake the cure of the fistula. No good can arise from an operation under these circumstances; but if you perform it, one of two things will happen—either the sinus, although laid open, will never heal, or otherwise, it will heal as usual, and the visceral disease will make more rapid progress afterwards, and the patient will die sooner than he would have done if he had not fallen into your hands." The frequent motion caused by the contraction of the sphincter ani being the principal obstacle to the healing of fistula in this situation, the immediate object aimed at by operation is the division of that muscle. In complete fistula this may be readily accomplished by introducing the fore-finger of one hand into the rectum, introducing a curved blunt-pointed bistoury through the fistula into the rectum, resting the point of the fore-finger against the back of the point of the instrument in the rectum, bringing it down through the anus, and dividing the sphincter. The instrument should always be made to pass into the bowel through the internal opening, and the parts below it divided; but any division of the bowel above that opening is perfectly unnecessary. When no internal opening exists, the bistoury should be pressed into the bowel at the usual situation of that opening, where the coats of the rectum will be found to be attenuated; and when there is no external opening, the integument covering the under part of the fistula, which will be found thin and unsupported, and surrounded by a part which feels thick and hardened under the adjacent portions of the skin, should be divided so as to make an external opening, and then the same operation as for complete fistula is performed. A little lint dipped in oil should be introduced immediately after the operation, and the parts afterwards dressed for some days with lint soaked in some lotion.

Fig. 258.



From Liston.

HÆMORRHOIDS.

Hæmorrhoids, or piles, are swellings at the verge of the anus, presenting varieties both as to situation and nature.

The *causes* of hæmorrhoids have been arranged into predisposing and exciting. To the former class may be referred habitual constipation, sedentary occupations, pregnancy, abdominal tumours, some affections of the liver, and any condition capable of retarding the circulation in the portal system, or of preventing the free return of the blood from the veins of the rectum. To the latter class belong straining at stool—irritation of the rectum induced by hardened fæces, by purging, or by tenesmus—sympathy of the rectum with affections of the urinary bladder—and long maintenance of the erect posture, by which the flow of blood is rendered difficult in the portal system, unprovided as it is with valves. Such are some of the predisposing and exciting causes. The rationale of their operation will be readily perceived, when the nature of hæmorrhoidal swellings is explained.

Varieties as to situation and nature.—Hæmorrhoids are called external or internal, according as they are without or within the sphincter ani.

External Hæmorrhoids.—With regard to anatomical characters, external hæmorrhoids may be said to consist of a varicose condition of some of the hæmorrhoidal veins. The veins may be merely dilated, and the cellular tissue around them in a natural state; or they may be dilated and inflamed, presenting the varieties with regard to condition of coats and contents mentioned in the description of the parts in phlebitis, with the surrounding cellular tissue more or less inflamed, or containing products of inflammation, or, if the hæmorrhoids have been of long standing, more or less hypertrophied. While external hæmorrhoids continue in a quiescent and indolent condition, the contents of the dilated veins remain in a fluid state, and comparatively little discomfort is experienced; but when they become inflamed, the pain and bearing down are great. The coats of the distended vein may at some parts give way, and a discharge of blood take place, constituting what has been termed open or bleeding piles; or the contents may become consolidated, as in the forms of phlebitis in other parts of the body; or abscess may be the result.

Internal Hæmorrhoids.—Of these there are three varieties. First, those which consist of erectile tissue which seems to be developed principally in the submucous cellular tissue.—Second, those which are of the same nature as external hæmorrhoids, consisting of portions of varicose veins covered by mucous membrane, and presenting the same varieties as to quiescence or irritability, and as to condition of coats and contents, with this difference, that they cause much more uneasiness and are attended with more sympathetic irritation,—the symptoms affecting the urinary organs being often very distressing.—The third variety, which rarely occurs, consists of those which are of the nature of simple sarcoma.

Treatment.—The treatment may be either palliative or radical.

The palliative treatment of external hæmorrhoids when in a state of inflammation, consists in the removal of the cause, if possible and proper, in local depletion by means of leeches, and in some cases by the free division of the hæmorrhoid, in regulating the bowels by gentle, non-irritating medicines, in the occasional use of the warm hip-bath, and in the strict observance of the horizontal position. In the chronic stage, the local part of the palliative treatment consists in the use of cold applications and astringents. The palliative treatment of internal hæmorrhoids when in a state of inflammation, may be said to consist in the employment of the remedies already mentioned as proper in the treatment of rectitis. The radical treatment proper to be instituted, having for its object the removal of the hæmorrhoids, differs greatly according as the hæmorrhoids are external or internal. In the former case, the proper and easy proceeding is, to remove them by the knife or the scissors; whereas internal hæmorrhoids, with the exception of the comparatively rare variety in which they are of the nature of simple sarcoma, can be safely removed only by ligature. The great danger of hæmorrhage, and the difficulty of averting it, have led almost all surgeons of much experience to this conclusion. The mode of proceeding is as follows:—The bowels having been well moved, the hæmorrhoids are made to protrude by straining, and the nates being separated from each other by an assistant, the tumours are seized with a volcella, and the surgeon ties them firmly by means of a silk thread round their roots, if they be small and pendulous; if otherwise, they may be transfixed at the base by a needle, and one-half included in each of the threads. The ends of the threads should then be cut off, the strangulated portions of bowel and that protruded carefully returned, and the patient confined to the horizontal position until the ligatures come away. An opiate should be given to allay pain and prevent motion of the bowels, and the state of the urinary organs attended to. If the patient complain of much discomfort, warm fomentations and poultices may be applied. To the benefit and satisfactory results of this method of treatment, I am sure that all surgeons, who have had sufficient experience of it, will be able to give the most favourable testimony. In cases in which the principal characteristic is a diseased condition of the mucous membrane placed over varices or altered cellular tissue —a form in which there is great irritation and often considerable loss of blood—Mr. Houston has used with advantage the nitric acid. The bowel having been made to protrude, and the part having been wiped with lint, the acid is applied to a small part; this is followed by the application of some oil to the same part, and the return of the protruded portions of bowel; after which an opiate is given. The surface is said in general to heal very rapidly after the separation of the superficial slough. I cannot say anything of this mode of treatment from personal observation, but in the class of cases above referred to, the result has been found by Mr. Houston and some others to be very satisfactory.

RHAGADES.

Fissures, excoriations, and cracks are very frequently met with at the verge of the anus, especially in persons much troubled with disorder of the digestive organs. They cause much pain, which is greatly increased while the bowels are being moved, and for a considerable time afterwards. They also give rise to spasm of the sphincter, which aggravates the pain; and if of long standing, they lead to permanent stricture. It is surprising how much suffering often results from a very small fissure in this situation. By the careful regulation of the bowels, attention to diet, and local treatment, consisting of application to the part of nitrate of silver, or nitric acid, this troublesome complaint is sometimes removed; but more frequently an operation is necessary, the object of which is to convert the fissure into a simple wound. This is effected by making a slight incision passing through the fissure, and dividing, according to the extent of the fissure, either the mucous membrane and submucous cellular tissue alone, or these parts together with the sphincter, so as to set the parts at rest; after which they heal up very kindly under the treatment for a simple wound, and the disease is removed. I have performed this operation in many cases, and never found it necessary to do more than make a longitudinal incision through the mucous membrane and the submucous cellular tissue; but many surgeons state that, in cases occurring in their experience, it has been necessary to divide the sphincter also.

PROLAPSUS ANI.

Prolapsus ani may be either partial or complete, and it may occur in children, in adults, or in persons of an advanced age.

Partial Prolapsus, which consists in protrusion of a portion of the mucous membrane, is chiefly met with in adults, is almost invariably induced by internal hæmorrhoids, and is immediately caused by exertion. The treatment of this variety—called by some authors partial prolapsus, by others prolapsus from hæmorrhoids—may be clearly understood from what has been stated regarding the treatment of internal hæmorrhoids.

Complete Prolapsus presents the appearance of a swelling, for the most part of a globular form, and consists of an invagination of a portion of the bowel, constituting a condition similar to that which, within the abdomen, is called intus-susception.

Complete prolapsus may be said to be almost entirely confined to infancy and childhood, and old age. In early life it is almost invariably induced by straining at stool, tenesmus, or violent crying; and any condition by which these causes are called into existence may lead to prolapsus, such as an acrid condition of the contents of the bowels, irritation of the mucous membrane, the presence of worms, pain in the bowels, calculus in the bladder, or the irritation of teething. This form of prolapsus has been called prolapsus from irritation. The treatment consists in returning the protruded part, and in using the proper means to prevent a recurrence of the protrusion. There are various proceedings by which the protruded parts may be returned. One is, having placed the patient in the horizontal position on his back or side, with the limbs drawn towards the abdomen, and having oiled the parts, with one hand to compress the neck of the tumour, and with the other to press up the swelling within the sphincter. While these manipulations are being performed, the patient should endeavour to avoid straining, which, by compressing the abdomen, would render replacement more difficult. Another very satisfactory mode is, to lay the patient on his face, to spread a dry towel over the protruded parts, and then to send a finger gently up into the rectum. The bowel adheres to the towel, and is carried up along with it. The margin of the anus should be compressed, while first the finger and then the portion of towel are being withdrawn. The treatment for the prevention of reprotrusion must depend on the condition by which the exciting cause of the prolapse is brought into operation. In persons of an advanced age, prolapsus for the most part occurs from weakness and want of retaining power of the sphincter. This form has consequently been called prolapsus from weakness. Some of its causes are, coughing, the erect posture, and walking to an extent to induce fatigue. After reduction, support by means of a compress and T bandage is necessary; and the treatment for preventing a recurrence of the prolapse must be adapted to the particular circumstances of the case. From what has been stated, it is hoped that the causes, the conditions, and the treatment of the three forms of prolapsus, namely, from hæmorrhoids, from irritation, and from weakness, will be clearly understood.

SIMPLE ORGANIC STRICTURE.

Seat.—This affection is commonly situated in the lower part of the rectum, about two or three inches from the verge of the anus, so that it can be readily reached with the finger, and its existence ascertained by examination. In some few instances it may have been found higher up, and some writers have expressed themselves with much confidence that this is its usual situation; but dissection has shown, and all the greatest authorities are agreed, that it is almost invariably in the lower part of the rectum.

Symptoms.—The principal symptoms are, pain, difficulty, and straining during defæcation,—the fæces when solid being passed in small, flattened, and narrow fragments, and, when fluid, ejected very forcibly. Of the early symptoms, difficulty of voiding the contents of the bowels is the most characteristic; and at an advanced period of confirmed stricture, the very frequent and forcible discharge of thin fæces, with a copious secretion of mucus frequently tinged with blood—a consequence of irritation of the mucous membrane—is one of the most remarkable features. Such are the principal symptoms, but it is by examination that the existence of stricture is ascertained with certainty. Sympathetic irritation of the bladder, pains in the back and legs, disorder of the digestive organs, and general debility, occur as the disease advances; and when not cured, it proves fatal for the most part by inflammation of the bowels, or by gradual sinking of the patient's strength.

Condition of parts.—There is a striking analogy between the condition of parts in stricture of the urethra and in that of the rectum. In each case the stricture, although in some slight degree constituted by induration and thickening of the coats of the canal in which it is situated, is chiefly—it might almost be said, entirely—constituted by deposit into the submucous cellular tissue; in the urethra, the part behind the stricture becomes dilated; in the rectum, the part above; in the urethra, the mucous membrane behind the stricture in many cases becomes ulcerated, giving rise to fistula in perineo; in the rectum, the mucous membrane above the stricture occasionally becomes ulcerated, giving rise to fistula in ano; in stricture of the urethra, there is sympathetic irritation of the rectum; in that of the rectum, there is sympathetic irritation of the urinary organs; and in disease of either canal, if not cured, death may be caused by gradual exhaustion, or by disease of more internal parts.

Treatment.—The treatment of stricture of the rectum consists in attention to the condition of the bowels, and in the cautious use of the bougie, with the view of restoring the canal to its normal size. The rationale of the treatment of stricture of the rectum by means of the bougie, is the same as that of the similar treatment of stricture of the urethra. The object aimed at in both instances is, to excite absorption by pressure; and in both great care must be taken not to use the instrument so often, or to allow it to remain so long, as to produce irritation, which would aggravate the disease instead of alleviating it. The simple introduction of the instrument is sufficient, and after the first operation, it is advisable to commence by inserting the bougie passed on the previous day, and immediately withdrawing it to introduce one of a larger size. This proceeding may be repeated every third or fourth day, or at longer or shorter intervals according to the time necessary for the subsidence of all uneasy sensations caused by the previous operation. Sometimes, even after the most gentle and careful use of the bougie, it is necessary to have recourse to the hip-bath and to opiate injections, in order to allay the irritation produced. In some cases, the stricture has been divided by slightly notching it at different parts by means of a blunt-pointed curved bistoury introduced upon the finger, after which the bougie is employed for the purpose of dilatation; but the very great risk of hemorrhage, the difficulty of checking it, and the danger of inflammation from wounds of the rectum, are serious objections to this proceeding, which should only be resorted to in extreme circumstances, and then with the utmost possible caution. The different operations which have been practised for the relief of obstruction of the bowel owing to stricture, and other causes, have been described in the section on the formation of an abnormal anus.

MALIGNANT STRICTURE OF THE RECTUM.

The principal points in which the symptoms of this affection differ from those of the former are, that they are much more severe; there is a constant dull shooting pain in the part affected, and in the back, extending down the limbs; there is an extremely offensive discharge of blood and matter from the part ; ultimately the power of retaining the contents of the bowels is lost ; and the symptoms affecting the urinary organs are much more distressing. The patient loses flesh and strength ; his countenance assumes a yellow appearance, characteristic of malignant disease ; and he presents the other symptoms of constitutional cachexy. The rectum is very irregular on its internal surface, and is usually affected along a considerable extent. Palliation is the only treatment the disease admits of.

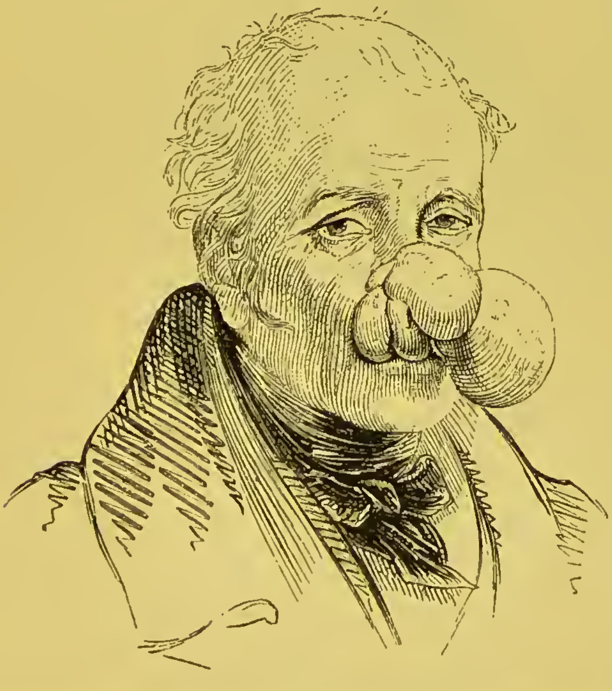
CHAPTER XXV.

AFFECTIONS OF THE NOSE.

LIPOMA OF THE NOSE.

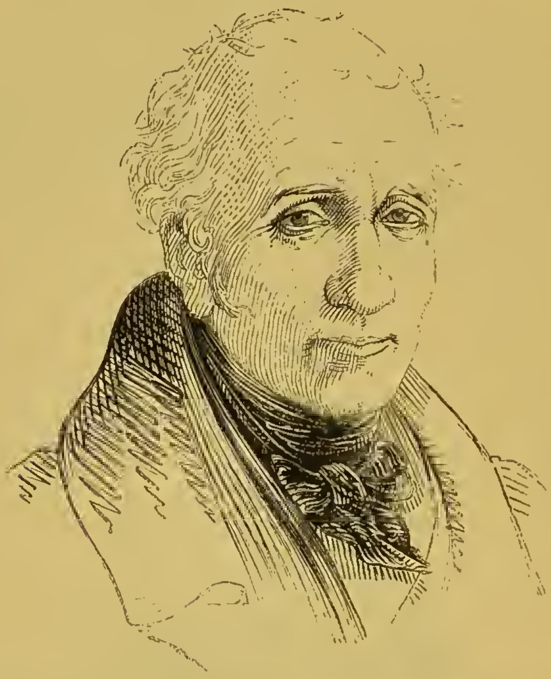
To a hypertrophied condition of the subcutaneous adipose tissue of the nose, the term lipoma of the nose is applied. These lipomatous enlargements of the nose seem to be restricted to the skin and subjacent tissue of the apex and alæ. The histological characters of lipoma have already been described.

Fig. 259.



The swellings are pendulous and loose, very insensible, slow in their growth, of a purplish or livid red appearance, as if produced by passive congestion; and, although unattended with pain, create discomfort and annoyance by interrupting vision, interfering with the functions of the nose, rendering it difficult to take food or liquid with comfort, disfiguring the appearance, and in some cases confining the breathing when the patient is in a horizontal position. Removal is therefore to be desired, and can be effected without danger or difficulty; the cicatrix becomes ultimately firm and depressed; and when completely removed, the swelling does not return. Until of late, surgeons generally appear to have been deterred from interfering with these lipomatous swellings of the nose, probably from a dread of hemorrhage. Some good cases, however, are recorded, in which the late Mr. Hey of Leeds, Mr. Barlow of Blackburn, M. Civadier, and M. Thuelot, have performed this operation; and my late kind friend Mr. Liston operated on the patient from whom the accompanying sketches were taken. The first conveys an excellent idea of this disease in a very aggravated form, and the second, of the very satisfactory result of the operation. Mr. Liston gives the following directions:—"An incision should be made through the diseased integument and cellular tissue in the mesial line, upon the cartilages of the apex and columna, not however so as to injure them; an assistant places his forefinger in one nostril, and the surgeon, seizing the mass either in his fingers, or with a small vulsellum, proceeds to dissect it off with a scalpel; the incisions must be carried close to the cartilages of the alæ, until the one side is cleared, the edge of the opening being well observed and not encroached upon. The assistant will give warning if the knife at any stage of the proceeding approaches his finger. The surface is trimmed a little, if occasion requires, with a thin, slightly curved, or knife-edged scissors. A similar proceeding is observed on the opposite side, so as to make the part as symmetrical as possible." Any troublesome general oozing may be stopped by the assiduous application of pledgets of lint, moistened with cold water. When the discharge has ceased to be coloured, tepid water-dressings should be applied, and granulation promoted.

Fig. 260.

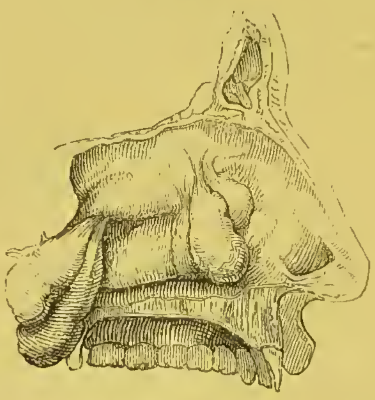


POLYPUS OF THE NOSE.

Varieties.—The varieties of nasal polypi are, simple, cystomucous, fibrous, and medullary. Careful discrimination of these different affections is very important, both for prognosis and treatment.

SIMPLE POLYPUS.

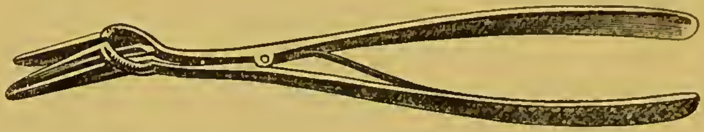
Fig. 261.



From Liston.

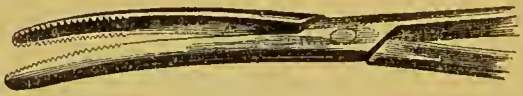
Characters.—Simple polypi occur at all ages, but are most common at the middle period of life; they are seldom single, and rarely confined to one nostril; they grow from the investing membrane of the nostrils, and almost invariably from that portion of it which covers the superior turbinated bones; sometimes, however, especially in children, they originate from the part of the membrane which covers the inferior turbinated bone, but never from the septum. On two different occasions I found, at post-mortem examinations, polypi of this class originating from the mucous membrane covering the side of the nostril, immediately above the inferior turbinated bone. The patient has a constant sense of stuffing; preternatural discharge of mucus; a feeling of cold in the head; a frequent desire to blow the nose, and a difficulty in doing so; impairment or entire loss of smell, often also of taste; and at an advanced stage, when the tumour presses back upon the mouth of the Eustachian tube, there may also be loss of hearing; then also speech is affected, becoming indistinct and snuffling. The symptoms are aggravated during damp weather. After they have attained some considerable size, the polypi can be brought into view on blowing the nostril; they become so large as to fill up the whole of it, and often make the under part of the nose present a broad appearance, giving an unpleasant expression; but never, like some other polypi, cause separation of the bones. They are of a yellow-grey colour, have little sensibility, produce no pain, and have very little tendency to bleed. Lachrymation is a common symptom in consequence of pressure on the nasal duct. Simple polypus sometimes projects into the pharynx, of which Mr. Liston gives the accompanying delineation. Care must be taken not to mistake for this disease abscess in the nostril—projection of the septum to one side—general congestion of the mucous membrane—or hypertrophy of the inferior spongy bone. In every instance, the nostril should be carefully explored by means of the speculum, a drawing of which is here given. Valuable information will thus be obtained in doubtful cases as to the nature, form, and situation of the polypus; and also, after operation, as to whether or not the disease has been completely removed.

Fig. 262.



Treatment.—As a general rule it may be stated, that the best treatment is evulsion by means of a forceps. The blades should be applied to the neck of the polypus, which should be firmly grasped between them, and then by a gentle turn of the hand the polypus is separated and extracted.

Fig. 263.



Separation is effected not by pulling, but by twisting in one direction; in short, by one turn or twist of the hand. Care must be taken that it is the polypus only, that is between the blades of the forceps; and all violent efforts must be avoided, lest either the membrane or bones should be injured or detached. If hemorrhage should continue after some minutes, the nostril should be slightly plugged for a short time by introducing a long piece of lint by means of a blunt probe. The lint should, however, be withdrawn as soon as the tendency to oozing has ceased. Except in the very rare case of a single polypus, several operations are required before the nostril is perfectly cleared of the disease. This should be made known to the patient before the first operation, when extraction should be carried to such an extent as to enable the patient to breathe freely through the nostril. Subsequent operations should take place in eight or ten days, that is, when the irritation of the previous one has worn off. After one or more of these operations, there sometimes appears to be a return of the polypi. Strictly speaking, however, this is not a reproduction of those which have been extracted, but the coming into view of some which had been confined in anfractuosities and narrow parts of the nostril, or the growth of others which had previously been kept pressed down, but which the removal of the cause of compression has left free to grow. When it is believed that the nostril is perfectly cleared, the tendency to return should be combated, and a healthy condition of the lining membrane promoted, by gently touching the part with nitrate of silver, and by the use of astringent lotions. When polypi are attached to the mucous membrane covering the inferior turbinated bones—which is very rarely the case, except in children—extraction is very safely effected by cutting the neck of the polypus with a pair of narrow probe-pointed scissors, while its base is held, and then brought out by means of a spring-forceps. In adults, also, these instruments are in some cases convenient for accomplishing extraction; but, as a general rule, evulsion by the forceps is to be preferred.

CYSTO-MUCOUS POLYPUS.

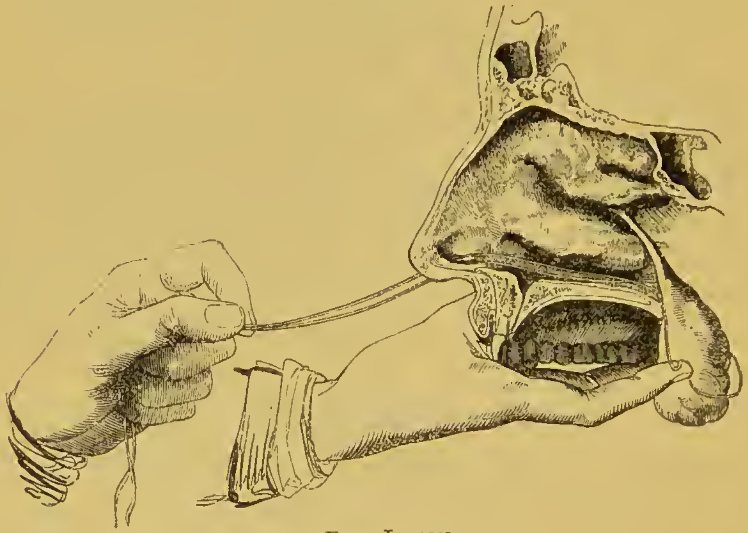
This variety of polypus so much resembles the preceding in form, in situation, in its attachment not extending deeper than the mucous membrane, in symptoms, in the mode and result of treatment, and in many other particulars, that it is only necessary to remark, that the colour is paler, that it does not present a uniform structure, but consists of various cysts filled with a mucous fluid, and that the parietes of the cysts are much more dense than the substance of simple polypus.

FIBROUS POLYPUS.

The peculiarities of this form of polypus were first pointed out by the celebrated M. Dupuytren, who gave it as his opinion that the fibrous polypus often degenerates into the medullary. This opinion has been also held by many other observers; but Professor Syme, whose experience in this department has been large, doubts its correctness, on the ground that medullary tumours in this situation exhibit their distinctive characters at a very early period, and that he has seen fibrous polypi retain their distinguishing peculiarities after they had been of long standing and had attained a great size. The pain is severe; the texture of the polypus is firm, like that of fibrous tumour, of which this variety of polypus of the nose is a good example. It is most common in males between the adult and middle periods of life; it is pyriform, pendulous, hanging down into the throat; and is remarkable for its tendency to bleed, for the great size it attains, and for its attachment being to the periosteum, and not to the mucous membrane alone. Another point in which this variety differs from the preceding is, that the polypus is single. If not removed, it may prove fatal by hemorrhage, suffocation, or pressure on the brain. The principal peculiarities may be stated briefly as being,—attachment to the periosteum, rapidity of growth, great size, being single, great tendency to bleed, separation of the bones of the nose, and a much more aggravated character of all the symptoms than in the two previous varieties.

Treatment.—In this variety, the polypus very frequently hangs down into the throat. One mode of proceeding is, to seize the root with the forceps, detach it from the periosteum, and press the polypus back into the throat. In this way the disease has in very many instances been completely removed. Another mode of proceeding very generally applicable to such cases is, to pass through the nostril into the pharynx a double of silver wire, catgut, or whipcord, which last Mr. Liston recommends—to guide the double around the body of the polypus by the fore and middle fingers,—and then to draw the ends: this will send the double up around the neck of the polypus, which is to be strangled, by bringing the ends through a double canula, and fixing them tightly at its extremity.

Fig. 264.



From Liston.

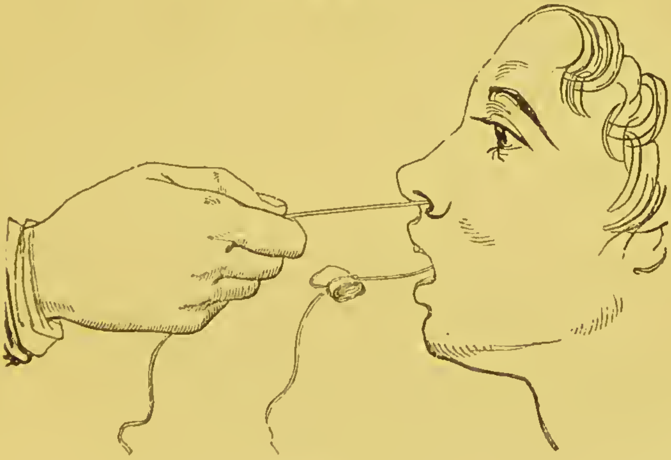
MEDULLARY POLYPUS.

Medullary, bleeding, and malignant, are the titles given to this perfectly incurable form of polypus. The principal distinctive characters are, that it usually occurs at the middle and later periods of life; that it commences in the bones of the nasal parietes; that its growth is in general rapid; that it is attended with great pain; attains a great size; and causes a separation of the bones of the nose, and, in consequence, a very unpleasant expression of countenance; that it has a great tendency to bleed; and emits a very offensive bloody discharge; that it is always soft—so much so, that a forceps will often take away only the portion between its blades; and that, in addition to the usual symptoms of polypus in an extremely aggravated degree, the patient ere long exhibits the usual signs of malignant cachexy. In this, as in other malignant diseases, the only relief the surgeon can give, is to palliate the most urgent symptoms; and with regard to local interference, there can be no doubt that it is exceedingly desirable, if possible, to avoid it altogether, as patients are likely to live longer if nothing be done. Sometimes, however, to prevent suffocation, portions of these tumours are cleared away; but cases not unfrequently occur, in which the least interference causes so much hemorrhage and irritation, that even this proceeding, for the relief of an extremely urgent symptom, cannot be resorted to without great danger. The language of one of the greatest surgical authorities in regard to these tumours in the nose, is, "Such growths, when they present in the nostrils, are perfectly irremediable and uncontrollable by any surgical proceeding."

OPERATION OF PLUGGING THE POSTERIOR NOSTRIL.

The principal remedies for arresting spontaneous epistaxis are, perfect quiet, absence of stimuli, and the internal use of gallic acid, elevation of the head, local application of styptics, compression of the nostrils, and the methodical introduction of lint through the anterior opening of the nasal fossa. It is very seldom that the last-mentioned proceeding has not the desired effect; but when the above remedies are not successful, it is necessary to plug the posterior nostril. This may be readily accomplished by sending a piece of silver or other wire, or of catgut, with a ligature fixed to it, along the floor of the nostril, into the throat; bringing one end of the ligature through the mouth, by taking hold of it with a forceps when seen in the throat, and the other through the nostril, by drawing out the wire. The most convenient mode of introducing the ligature, however, from the nose to the throat, and for bringing back one end through the nostril, is the exceedingly suitable instrument contrived for the purpose.

Fig. 265.



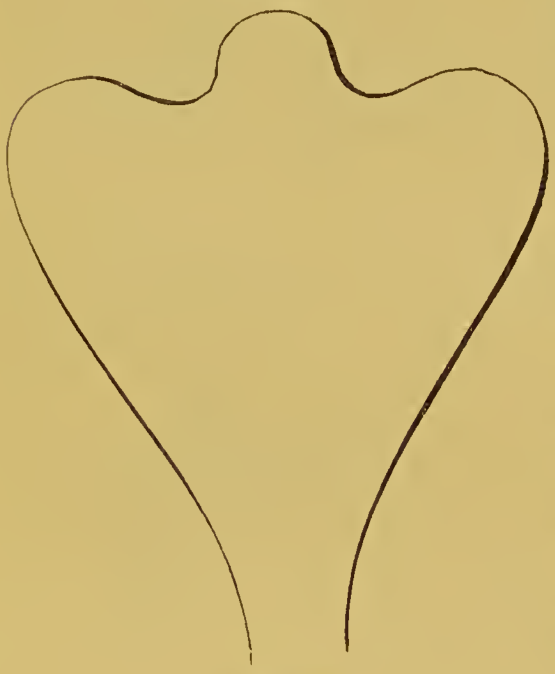
From Liston.

To the portion of ligature coming through the mouth a bit of lint proportioned to the size of the posterior nostril is attached, and by drawing the nasal extremity of the ligature, and guiding the plug behind the velum pendulum palati, it can be lodged in the posterior nostril. This being done, the anterior nostril should be methodically filled with a long narrow bit of lint, when the hemorrhage will be completely commanded.

RHINOPLASTICS.

Restoration of the whole nose is now performed as follows :—The cicatrized remains of the old nose having been pared down to a considerable depth, so that the edges and the whole surface are made raw—to which a flap borrowed from the forehead is to be applied—a piece of soft leather, shaped of the size required to form the apex and alæ, is placed on the forehead, with the narrow part between the eyebrows, and the broad part upwards. The outline of the flap having been marked with ink or with a knife, the flap is dissected down, care being taken to make it of uniform depth, and not to interfere with the pericranium. The neck of the flap should be made sufficiently long to admit of its being turned round without injury to the circulation, and to facilitate this turning round, it is advisable to make the incision a little longer on the side to which the twist is to be made. Bleeding having ceased, the flap should be turned round, and its edges, after being carefully adjusted to the margins of the remains of the former organ, secured by sutures; a little oiled lint is placed in the nostrils to support the flap, and no further dressings are applied to the part. The edges of the wound in the forehead at its lower part are brought together by a suture, and the remaining part treated with tepid water-dressings to promote granulation. The organ having become consolidated, restoration of the columna may be accomplished by the following operation, recommended by Mr. Liston, and practised by him with great success :—" The inner surface of the apex is first pared. A sharp-pointed bistoury is then passed through the upper lip, previously stretched and raised by an assistant, close to the ruins of the former columna, and about an eighth of an inch on one side of the mesial line. The incision is continued down, in a straight direction, to the

Fig. 266.

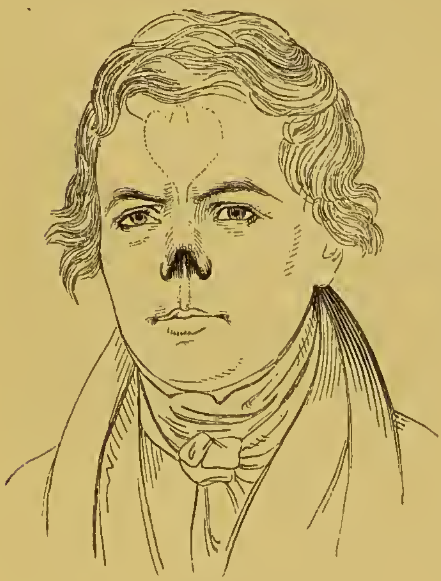


From Liston.

free margin of the lip; and a similar one, parallel to the former, is made on the opposite side of the mesial line, so as to insulate a flap composed of skin, mucous membrane, and interposed substance, about a quarter of an inch in breadth. The frænulum is then divided, and the prolabium of the flap removed. In order to fix the new columna firmly and with accuracy in its proper place, a sewing needle—its head being covered with sealing-wax to facilitate its introduction—is passed from without through the apex of the nose, and obliquely through the extremity of the elevated flap: a few turns of thread suffice to approximate and retain the surfaces. It is to be observed that the flap is not twisted round as in the operation already detailed, but simply elevated, so as to do away with the risk of failure. Twisting is here unnecessary, for the mucous lining of the lip, forming the outer surface of the columna, readily assumes the colour and appearance of integument, after exposure for some time, as is well known. The fixing of the columna being accomplished, the edges of the lip must be neatly brought together by the twisted suture. Two needles will be found sufficient, one being passed close to the edge of the lip; and they should be introduced deeply through its substance; two-thirds, at least, of its thickness must be superficial to them. Should troublesome bleeding take place from the coronary artery, a needle is to be passed so as to transfix its extremities. The whole cut surface is thus approximated; the vessels being compressed, bleeding is prevented; and firm union of the whole wound is secured. The ligature of silk or linen, which is twisted round the needles, should be pretty thick and waxed; and care must be taken that it is applied smoothly. After some turns are made round the lower needle, the ends should be secured by a double knot; a second thread is then to be used for the other needle, and also secured. With a view of compressing and coaptating the edges of the interposed part of the wound, the thread may be carried from one needle to the other, and twisted round them several times; but in doing this, care must be taken not to pull them towards each other, else the object of their application will be frustrated, and the wound rendered puckered and unequal. Last of all, the points of the needles are to be cut off with pliers. No farther dressing is required. As previously remarked, no good end can be answered by any application, and the separation of dressing may afterwards be troublesome; discharges from the neighbouring passages are retained by it, fœtor is produced, and union interrupted. The needles may be removed on the third day; their ends are cleaned of coagulated blood, and, after being turned gently round on their axis, they are to be cautiously withdrawn, without disturbing the thread or the crust which has been formed about them by the serous and bloody discharge. Some care is afterwards required from the surgeon and patient in raising the alæ, by filling them with lint, and thus compressing the pillar so as to diminish the œdematous swelling which takes place to a greater or less degree in it, and to repress the granulations. It is besides necessary to push upwards the lower part of the column, so that it may come into its proper situation; and this is done by the application of a small round roll of linen, supported by a narrow bandage passed over it and secured behind the vertex. Independently of the great improvement produced on the patient's appearance by the restoration of the lost part of so important a feature, it may be observed, that, when the columna has been destroyed, the lip falls down, is elongated, and becomes tumid, particularly at its middle, so that borrowing a portion from it materially ameliorates the condition of the part; and the cicatrix being in the situation of the natural fossa, is scarcely observable."

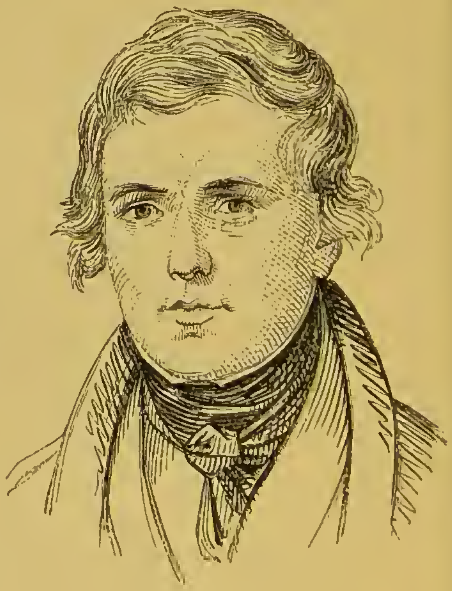
Mr. Liston further remarks, "The sensation of the interior is much less acute, and of a different nature; and, indeed, when handled, the sensation so occasioned may be referred to 'the parent' breach in the forehead—though this is not by any means so common an occurrence as many assert. After a time, however, the interior is lined with what resembles a mucous membrane, and exhales a mucous secretion. One of my patients I have seen enjoying a pinch of snuff, in which he largely indulged, apparently with as much gusto as the oldest and most experienced nose could possibly have imparted. But even should our constructions fail in this accomplishment, a nose is still a nose, 'although there's nothing in't.'" In one thing the surgeon cannot be too careful. When the organ has been lost by ulceration, he must be well satisfied that all tendency to return of the morbid action has

Fig. 267.



From Liston.

Fig. 268.



From Liston.

ceased, before he ventures to affix a new and healthy substance, otherwise adhesion will fail; or ulceration will destroy, in whole or in part, what it was his object to raise perfect and entire.

AFFECTIONS OF THE ANTRUM.

The antrum is not unfrequently the seat of collections of matter of various kinds, and sometimes of polypi. It is not unfrequently occupied with a fluid of a clear and glairy appearance. Some remarkable examples of this class are recorded, and two have come under my own observation. In cases of this nature the fluid is sometimes slightly puriform, and very often resembles in appearance the fluid found in cysts in other parts of the body. The walls of the cavity become expanded, attenuated, and in some cases so thin as to crackle on pressure. Collections of this nature are not attended with symptoms of the inflammatory process. The antrum is also subject to acute and chronic abscess; but the former rarely occurs, except in consequence of violence applied to the bone, or of very acute disease in the teeth or gums. In all such instances the grand indication is, to make early, free, and dependent opening for affording complete evacuation and preventing reaccumulation. If the canine or one of the molar teeth be diseased, it should be extracted; the matter often escapes through the empty socket, and it is a frequent practice to enlarge this communication by sending a trocar through the empty socket into the antrum; but the more effectual mode of procuring evacuation and preventing reaccumulation is, to make an early free opening by dividing the membrane of the cheek and the attenuated parietes immediately above the molar teeth. The antrum is very rarely the seat of any kind of polypus, except the malignant, which is, of course, as irremediable here as it is in the nostril. It is of great consequence not to confound this affection or osteo-cephaloma of the jaw with osteo-sarcoma; the former being certain to prove fatal, and the latter as certain to be cured by excision of the upper jaw, an operation described in the chapter on Resections of Bone.

CHAPTER XXVI.

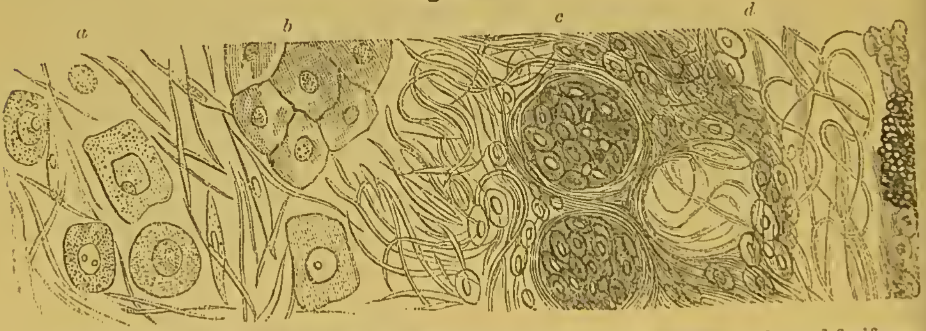
AFFECTIONS OF THE MOUTH, THROAT, AND WINDPIPE.

AFFECTIONS OF THE MOUTH.—CANCER OF THE LIP.

THIS disease is almost entirely confined to the under lip. I have never seen it in the upper lip as a primary affection, and very rarely, indeed, as an extension from the lower; and it is well known that such extension seldom takes place. The greater liability of the lower lip to this disease is supposed to arise from its being much more exposed to irritation on account of its situation and mobility. This affection is more frequent in males than in females, and like all others of the same class, is more common after than before the middle period of life. Very lately, however, in the Royal Infirmary, I removed a scirrhous tumour from the lip of a female under twenty years of age. In that case the common and microscopic characters of carcinoma were exceedingly distinct.

The disease may originate in a carcinomatous tumour in the lip, over which the skin or mucous membrane at last ulcerates, so that a cancerous sore is constituted; or in a warty excrescence, which degenerates into cancerous ulceration; or in a superficial chap, ulcer, or excoriation. This is the scirrhus form of carcinoma. The lip is liable to another variety of this disease, known by the names of epithelioma and epithelial cancer. The common and microscopic characters, the history and progress of these diseases, have already been described in the chapter on Carcinoma.

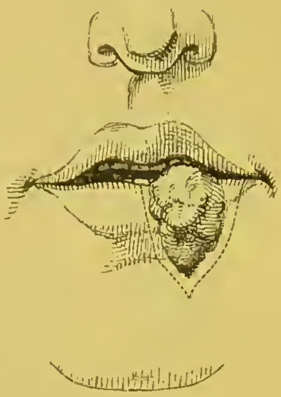
ig. 269.



Appearance of section of cancerous tumour of the cheek. *a.* Epidermic scales and fusiform corpuscles on the external surface. *b.* Group of epidermic scales. *c.* Fibro-elastic tissue of the dermis. *d.* Cancer cells infiltrated into the fibrous tissue, and filling up the loculi of dermis. —From BENNETT.

Treatment.—The proper proceeding is the entire removal of the mass by excision at the earliest possible period. When the disease is confined to a moderately narrow space, the lip is seized by the forefinger and thumb of the left hand, and drawn out from the gum. Two straight converging incisions are then made downwards with a sharp bistoury, so as to meet in a point below, including the whole diseased part along with a small border of sound tissue in the triangular or V shaped piece, which is thus removed. I generally perform the excision with a single stroke, employing for that purpose a very narrow straight bistoury, which being carried down one side admits of being rapidly turned at an acute angle; after which it is brought up on the other aspect of the tumour. By this method excision can be very rapidly accomplished, and by using a very narrow knife, the angle at the bottom of the wound can be made as sharp as by the usual methods of making two distinct incisions both carried downwards, or of making one incision by transfixing, and the other by cutting downwards. Before the operation is commenced, the angles of the mouth may be compressed so as to prevent the flowing of blood from the coronary arteries during its progress; or the same purpose may be effected by pressing on the facial artery, on each side as it runs on the groove at the union of the middle with the posterior third of the base of the inferior maxilla.

Fig. 270.



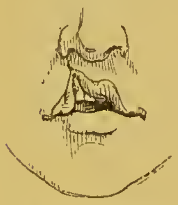
From Liston.

The wound is treated afterwards as in cases of hare-lip, and the necessity of tying bleeding vessels is obviated, by making the needles of the twisted suture transfix those points from which blood would otherwise flow in any quantity. When the disease affects the greater part or the whole of the breadth of the lip, the proper proceeding consists in removing the whole of the disease, and performing the operation of Serre of Montpellier, for restoration of the lower lip. This operation will be afterwards described.

HARE-LIP.

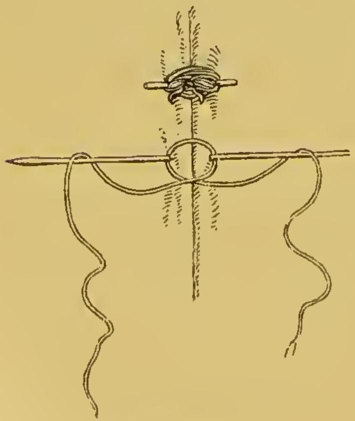
Hare-lip is the name applied to the condition in which one or more fissures exist in the upper lip. It is usually congenital, and caused by arrest of development; but it may be induced accidentally by wounds. The fissure, when single, is usually in the central line, though sometimes it is situated a little towards one side: when there are two fissures, they are generally placed below the apertures of the nostrils; and in this case, the central portion of the lip may be either of the full length, or, as is more usual, merely a short rounded process. A mesial portion of the superior maxillary bones frequently projects forwards, more especially in double hare-lip. Cleft palate is a frequent accompaniment of this condition. Hare-lip, when very slightly marked, may not much impede the child's sucking; but when it is to a greater extent, it may do so very much—nay, even render it impossible. The best time for an operation for the removal of this deformity is, when most of the temporary teeth have come through the gums: this is the time usually preferred by the surgeon, when it rests with himself to decide; but when parents are unwilling to have the operation delayed, he performs it before the commencement of dentition. It has, however, been done with perfect success, and without any unpleasant results, at all ages, from two months upwards; but it is not desirable, and certainly it is not necessary, to operate earlier than three or four months after birth, as the operation can be well done at a later period, and no bad consequences are caused by delay. When a simple fissure exists without malformation of the upper maxilla, it may be rectified in the following manner:—A towel, or large cloth, having been wrapped round the child, so as completely to secure its hands and feet, and prevent all struggling, it is placed on the nurse's knee with the head secured between the surgeon's knees. He then seizes the lower corner of one side of the fissure, between the finger and thumb, and sends a sharp, narrow, straight-bladed bistoury through the lip, immediately above the apex of the hiatus, with its edge directed straight downwards; the blade is then slightly turned so as to direct the edge a little outwards, and is brought down, cutting off a thin slice from the edge of the fissure. The opposite corner of the lip is next seized, the bistoury is introduced at the same point, and is made to cut off a similar slice from the other side. In a central fissure these two incisions, though smooth and uniform, should not be exactly straight; they should be very slightly curved with the convexity directed outwards, so that, when the margins are approximated, the natural fulness of the prolabium at this point may be preserved. Without this little precaution there usually remains a notch in the lip, which is unseemly, however small. Approximation of the clean cut edges having been effected, one or two common sewing needles of suitable size, and provided with a knob

Fig. 271.



From Liston.

Fig. 272.



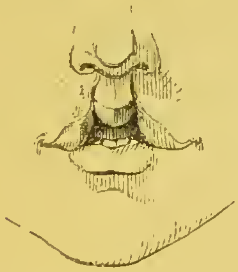
From Liston.

of scaling-wax on the head to serve as a handle, or needles with spear points, or pins with spear points, both of which are made expressly for this operation, are introduced so as to transfix both margins, passing through about two-thirds of the thickness of the lip, but not penetrating the mucous membrane. Their points are broken off with a forceps, and a waxed ligature is then twisted in the form of the figure 8 around their extremities, which emerge from the integument at a little distance from the margins of the wound on each side. Each needle is supplied with a separate ligature; because if the same thread be continued from one needle to the other, puckering of the wound between the two is apt to be produced. No dressing whatever should be applied over the wound.

In this operation it is of great importance to have the edges evenly and uniformly cut, meeting at a sharp angle above, so as to facilitate accuracy of coaptation. The sharpness of the bistoury, and its being narrow-bladed, will contribute much to the accomplishment of both these ends. One of the needles may be removed in two or three days, by gently twirling it round as it is withdrawn, the wax thread rendering this manipulation easy: the other may be taken away two days afterwards, or in many cases even sooner; but the twisted threads which have been soaked in the oozed blood, and in drying have become strongly adherent, may be left undisturbed for several days longer.

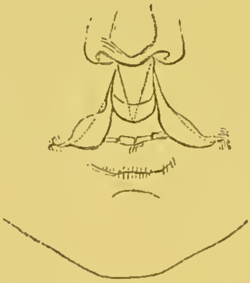
A double fissure, without malformation of the upper jaw, is treated on similar principles. The lip, if tightly adherent to the gum, is loosened sufficiently by cutting the mucous membrane. Then, if the central lobe between the two fissures be of full breadth and length down to the prolabium, the margins of both fissures are pared, forming two complete and separate lines of wound: but if the central portion be short and rounded, it is sliced so as to bring it to a point at the bottom, as is represented in the accompanying wood engraving, and the margins on each side being also pared, are brought together, embracing this little part above, but coming into contact with each other below. In both cases the same needles serve for both slits, being made to transfix the central piece without appear-

Fig. 273.



From Liston.

Fig. 274.



From Liston.

ing on its surface, and emerging on the skin a little beyond the outer edge of each fissure. The threads are wound round as before. In all cases it is preferable to operate on both sides at once, and not to make two operations at different periods.

When there is malformation of the upper jaw, so that it projects slightly in the centre, the case may be treated without any peculiarity of proceeding; for the steady yet gentle pressure of the united lip, as I have often seen in cases coming under my own observation, gradually depresses the prominent piece of bone, at least in young children. But if it project so much as to prevent the possible closing of the fissure over it, it may generally be pressed back by a suitably contrived spring pad, which is kept applied with a gentle degree of pressure for a few hours daily during some weeks, after which the operation may be performed. This is preferable to snipping off the piece of bone with the forceps, a proceeding very rarely indeed necessary in these cases. When any teeth project very much forward, they should be extracted previous to the operation, as the irritation caused by them would be apt to prevent adhesion. In order to prevent the needles from keeping up a strain and tension of parts in cases where the fissures are very wide, which might lead to their being set free by ulceration, and thus produce return of hare-lip, several varieties of apparatus have been employed to press the cheeks forwards towards the mesial line. The best for this purpose is the apparatus employed by Mr. Fergusson. It consists of a spring, forming the greater part of a circle, with a soft pad affixed to each extremity, and a strap to prevent the apparatus from falling too far down; the pads being directed forwards, and intended to press in the cheeks and prevent their retraction, after they have been drawn forwards by the fingers of an assistant. By using this apparatus, and by attending to a most important point, namely, the free division of the mucous membrane when necessary, so as to liberate the soft parts from the bone, and admit of their being brought forward, the worst possible deformity of this nature is capable of being perfectly cured.

RESTORATION OF LIP.

Restoration of a lip is an operation occasionally demanded; in some cases merely to prevent deformity, in others to remove more serious inconveniences, such as imperfect articulation, and a constant flow of saliva outwards.

The *upper* lip is but little subject to disease, though exceedingly liable to congenital fissures. These, however, are usually so narrow that their sides can be approximated without difficulty. But if the operation for hare-lip be performed several times on the same individual, and as often fail, the repeated paring of the edges, and the ulceration which sets the needles free, destroy the lip to such an extent that it may be impossible again to bring the parts together without incurring one or other of the following consequences,—either the commissures of the mouth will be dragged inwards so as nearly to meet under the columna of the nose ; or, if the apposition be partially effected at the upper angle of the fissure, the free border of the lip thus left will be composed of the irregular margins which *ought* to have formed a direct continuation of the vertical junction above, and not a line obliquely transverse to it ; and its rounded corners, at the point of union in the centre, will leave a retiring angle, sufficient still to afford to the lip a decidedly leporine appearance.

When the upper lip has been destroyed in this manner, Mr. Syme restores it by the following method:—After paring evenly the edges of the gap, which resemble the limbs of the capital A set very widely, or at an obtuse angle, he makes an incision about an inch and a quarter long, or about the same length as the pared border, across each cheek, outwards and a little upwards, in the direction of the zygoma. These four incisions resemble a widely-printed W. The margins of the central gap can now be readily approximated, and secured in the usual way by the twisted sutures. A stitch of the interrupted suture may be required at the outer part of the lateral incisions, the upper margins of which, being drawn inwards, chiefly form the prolabium, while the natural elasticity of the integument prevents the injurious straining of this edge, or the rough corrugation of the lower border.

The *lower* lip, much more frequently than the upper, requires to have a large portion removed, when the intractable or malignant affections, to which it is so liable, have been allowed to pursue their course for a considerable period. Here the gap is generally of more formidable dimensions, and is more inconvenient than even an extensive fissure of the upper lip, as there is in this case greater difficulty in restraining the outward flow of saliva.

Professor Syme has successfully restored the deficiency by the following operation :—A triangular excision of the diseased mass having been made, two straight incisions are carried from its apex downwards and outwards, *nearly* in a continuous line with the cut margins of the V shaped hiatus, forming thus far the letter X. Each of these lower cuts is finished off by being continued outwards for a short distance in a curve, the convexity of which is directed downwards, and the free extremity turned upwards. The flaps thus formed are detached from their underlying connexions, as far outwards as the extremities of the gaps above, and of the curved prolongation of the downward incisions below. The obliquely-placed V margins, from which the diseased tissue has been cut, can now be made horizontal by raising their inferior internal angles, forming thus the free border of the new lip ; the outer edges of the straight parts of the incisions, which were carried obliquely downwards and outwards, become by the same movement vertical, and are brought into mutual apposition ;

and the curved portions immediately below and outside accommodate themselves along the sides of the triangular tongue of integument, from contact with which the straight margins of the incisions have just been elevated. The elasticity of the skin prevents any undue straining or unseemly corrugation, which might otherwise have occurred in the adjustment of these curved lower parts of each incision. The twisted suture is employed to retain in coaptation the vertical line of union thus effected, from the border of the lip down to the point where the two lateral parts of the wound branch off. The lower of the three or four needles required for this purpose should also transfix the apex of undetached skin which occurs at this last point. About the same number of stitches of the interrupted suture are then inserted, to connect the edges of each of the two diverging incisions below.

Professor Serre of Montpellier has suggested and practised a method of forming a new lower lip, presenting the two great advantages of being lined by a mucous membrane, and having no tendency to fall down. This consists in making two incisions, one from each end of the lip downwards, which meet in the mesial line a little above the pomum Adami. Other two incisions are then made horizontally from the angle of the mouth to the borders of the masseter muscles, in a line with the teeth of the upper jaw, and below the level of the parotid duct. These two latter incisions extend through the whole thickness of the cheeks. The flaps included between the incisions on each side are then carefully separated from the subjacent parts, and the margins brought together and retained by hare-lip pins and twisted sutures. The integument and mucous membrane are then also brought together at the edge of the new lip by means of a few simple sutures. I have frequently performed this operation, and consider it admirably adapted for the purpose for which it is intended.

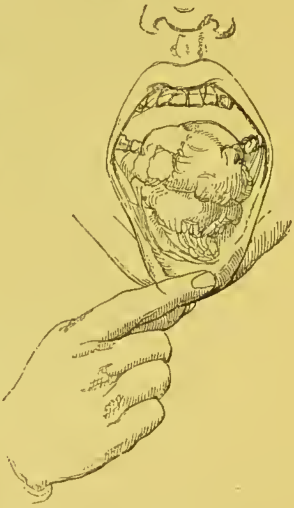
EPULIS.

Mr. Liston gave the following description of epulis, and of the operation for its removal :—

"The tumour of the gum, epulis, is often a simple growth of the same consistence as the structure from which it proceeds, and not likely to be reproduced when the exciting cause has been removed and the entire disease extirpated ; its frequent cause is decay of some part of one or more teeth,—the crown, neck, or fang,—or it may arise from their being crowded and displaced. The lower jaw is the most common situation of epulis, but the upper jaw is by no means exempt from it ; it usually appears in the front of the mouth, and occasionally at the root of the molares ; some of the large tumours in my collection, removed along with the upper jaw, appear originally to have commenced in the alveolar ridge. The size and extent of epulis are various ; it may be confined to the gum betwixt two teeth, or it may involve several if it had been long neglected ; and it may be attended with alteration in structure of the alveolar processes and their covering. The disease is generally connected with affections of the permanent teeth, but it is also met with as a disease of infancy. About eight years ago, I had occasion to remove a very large tumour of this nature along with several decayed temporary teeth, and their alveolar processes, from the lower jaw of a boy of ten years, in the North London Hospital. It was doubtful, from the extent of the disease, whether or not it might be necessary to remove the whole thickness of the bone to some extent; accordingly, the cheek was divided so as to expose it thoroughly and permit a satisfactory examination, yet in such a way as to leave no deformity; the tumour was insulated, and removed by a small saw and cutting-forceps, leaving the crown and pulps of the permanent molares exposed; and the parts healed over them. There is now no appearance whatever of disease, and very little of any operation having been performed; the permanent grinders are coming forward, and appear quite regular and healthy.

"The tumour of the gum is of slow growth; it generally remains of the same firm consistence, and its attachments are broad and firm; its surface, even when large, is covered by smooth membrane, and is often unbroken, becomes lobulated, and unless it projects from the mouth and is exposed to injury, the teeth are loosened, and present in various parts of the tumour, and around their base some excitement may be kept up, with even some ulceration and discharge. The tumour is not of a malignant nature in general, and even in its advanced stages is not inclined to contaminate the parts in its neighbourhood; if thoroughly removed, it does not return. A soft tumour of the gum, rapid in its progress, broken on its surface, and furnishing fœtid and bloody discharge, is sometimes met with; there is no danger of mistaking the one kind for the other, the remediable for the malignant; and fortunately the latter is rare. One case of the hard cancer of the gum and alveolar ridge of the upper jaw was sent to the hospital very lately for operation, but of course refused. I have seen lately several cases of decidedly malignant disease springing from the gum. The two cuts introduced on the next page are intended to show the contrast between the fibrous benign tumour of the jaw, and the malignant growth from the gums. The one smooth on the surface, slow in its growth, and unattended by pain; the other ragged, rapidly increased, and attended with great suffering to the patient.

Fig. 275.



"The operation for the removal of epulis is modified according to the size and situation of the tumour; one or more teeth must always be sacrificed in order that the proceeding may be effectual. In general swelling and thickening of the alveolar ridge and its coverings, the mere removal of those bodies that are offending will often be followed by subsidence of all alarming appearances and uneasy feelings. But in order to extirpate effectually any morbid growth proceeding from the investments and roots of the teeth, these must first be extracted. There is no use in attempting to remove the tumours otherwise. The disease will be reproduced again and again, if any of the part affected is left, or if the tissue from which it grows is not extirpated with it. I saw a young gentleman some time ago, a pupil of the Junior School of the University, who had been subject to repeated operations for the removal of a small epulis, from which he had endured much, and on one occasion lost a good deal of blood; no teeth had been extracted. I laid hold, as a preliminary step, of the first large molar tooth, betwixt which and the second the new tumour lay. This was extracted, and along with it came the tumour, quite clean and entire, attached to the peridental membrane of the neck of the tooth. No incisions had been made, and there was no interference with the alveoli: the disease did not return. In dealing with growths of considerable size, after the removal of the immediately adjoining teeth, they must be surrounded by an incision made with a strong-pointed knife, and, if need be, part of the alveolar process is also taken away with cross-cutting forceps. If the tumour is large, and the alveolar process deeply implicated, it will be prudent, after having made the incisions, and

Fig. 276.

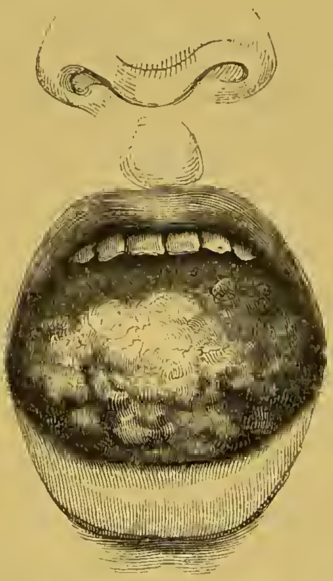


Fig. 277.

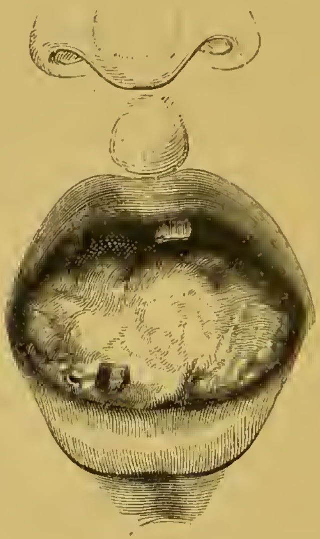
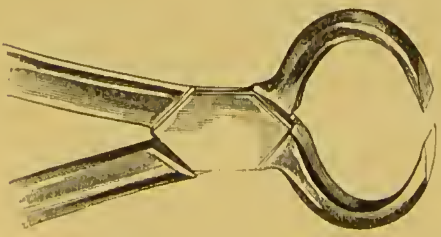


Fig. 278.



removed teeth on each side of the disease, to cut down the bone with a fine saw, before applying the forceps. In order to gain free access to large tumours connected with the molares, it will sometimes be prudent to divide the cheek to some extent; the pain and duration of the operation will thus be much diminished, a better chance will thus be afforded of making the proceeding effectual, and if matters are well managed, as regards the direction of the incision and the after dressing, there will be little or no consequent deformity. This rather severe proceeding of cutting open the cheek is, however, generally avoided, if the operator is provided with strong and well-made cutting-forceps, slightly bent beyond the joint.

Fig. 279.

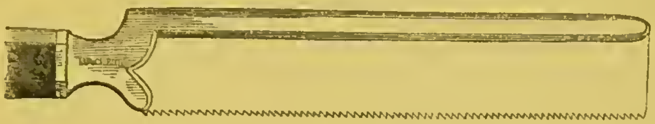


Fig. 280.

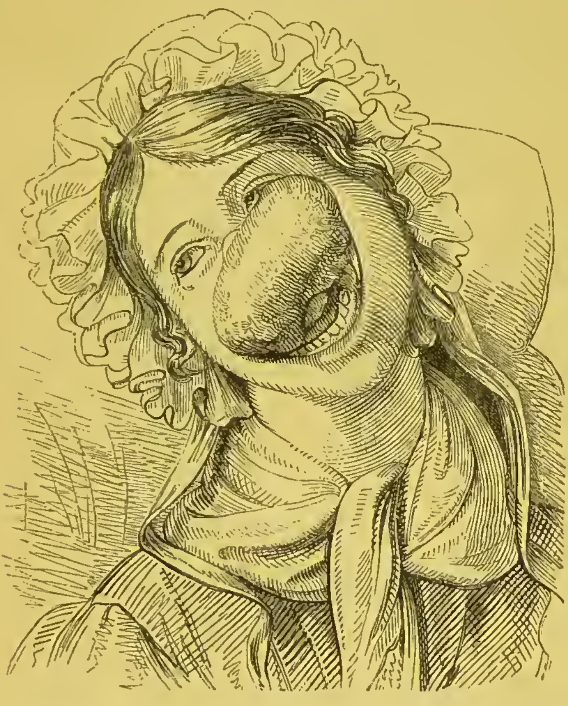
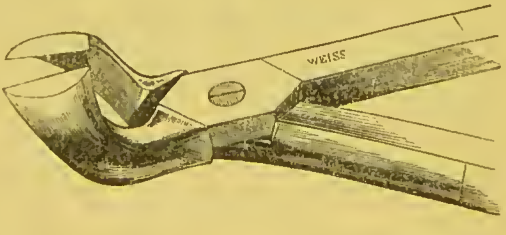
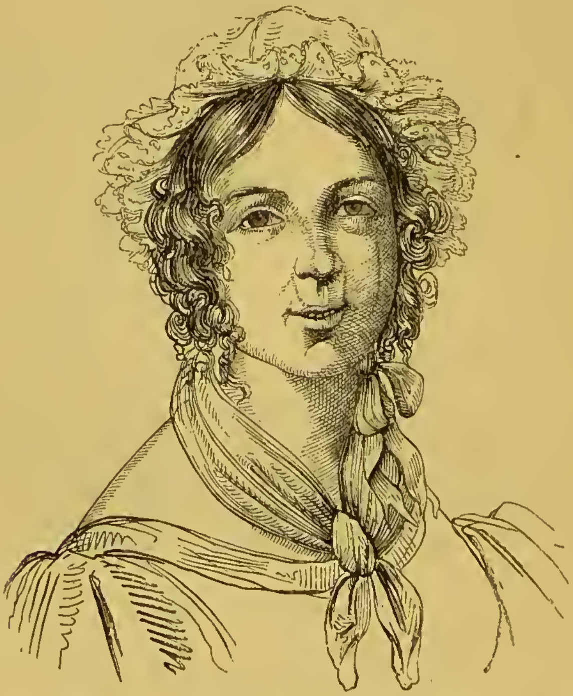


Fig. 281.



"Tumours commencing in the gum, sockets, or surface of the bone, are sometimes neglected so long, are allowed to gain such a size, and to take such a hold of the upper or lower maxilla, that the whole disease cannot be eradicated without at the same time taking away those bones in whole or in part. The superior maxilla, as already said, is often the seat of epulis, of unlimited growth, but still of a simple and benign disposition. I am almost inclined to believe, that the case from which the above sketch was made might have been originally of this nature. The tumour had been removed when recent, but only in part, and grew again, till after many years it presented the above very formidable appearance. It was extirpated successfully, as detailed in the 'Lancet.' The superior maxilla of one side, and part of the other, were necessarily taken away, yet the disease seemed to have sprung entirely, in the first instance, from the alveolar ridge; it overlapped the palatine arch and other parts of the bone, but these are unaffected; and the antrum, though narrowed a little, is quite free from disease, its lining membrane being entire and healthy. A sketch of the appearance presented before the patient left the hospital is here introduced, in order to show how little deformity remained after so formidable and extensive an operation. The scars on the upper lip are the result of the previous unsuccessful attempt to remove the disease. This patient came to the hospital in the course of this autumn (1845), on account of some internal ailment unconnected with her former malady, and altogether free from disease of the face."

Fig. 282.



FISSURE OF THE PALATE.

Congenital Fissure affects sometimes the uvula merely; sometimes the whole velum palati, the hard palate being entire; sometimes the bones only, the velum being entire; sometimes the velum palati and bones, as far forward as the alveolar process, in which case the fissure is invariably in the mesial plane; and sometimes the velum palati, the hard palate, and alveolar arch,—a case in which the fissure, if single in front, diverges a little to one side, where it goes through the arch, but if double, the state of the palate resembles the outline of the letter Y: sometimes, also, the fissure of the whole palate is combined with hare-lip.

Extensive fissure causes great difficulty in sucking, as the food in being swallowed passes through the nostrils; it also causes great impediment in articulation, rendering it exceedingly indistinct and disagreeable.

When fissure of the palate is combined with hare-lip, the first proceeding should be to remove the latter deformity; this having been effected, the velum palati, if the fissure be not of very great breadth, should be made the subject of operation: after which most surgeons recommend simply that the hard palate should be covered by a plate. For fissure of the hard palate alone, the advice hitherto usually given has been, that the patient should wear a plate properly prepared and fitted by a dentist; but Warren of Boston has proposed to detach the soft palate from the palatal arch, to vivify the edges of the detached portions, and to unite them in the middle by means of stitches. This operation has been practised by Mr. Pollock with perfect success, and constitutes another of the triumphs of modern surgery. For fissure of the soft palate, the operation of staphyloraphy, or velo-synthesis, is resorted to; an operation practised by Roux, Graefe, and others, but brought to its present greatly improved state by Professor Fergusson of King's College Hospital, who may be said to have proposed a new mode of staphyloraphy, the principle of which is, to divide the muscles that draw the flaps from each other and widen the fissure. By this means the velum is put into a state of repose, and the pared edges are in less danger of being pulled asunder during the process of union. Professor Fergusson divides the levator palati and palato-pharyngeus muscles, and in some cases the palato-glossus.

Mr. Fergusson gives the following description of his operation:— "With a knife whose blade is somewhat like the point of a lancet, the cutting edge being about a quarter of an inch in extent, and the flat surface being bent semicircularly, I make an incision, about half an inch long, on each side of the posterior nares, a little above and parallel to the palatine flaps, and midway across a line straight downwards from the lower opening of the Eustachian tube, by which I divide the levator palati on both sides, just above its attachment to the palate. If care be taken, in dividing the levator palati, not to run the knife towards the upper and back part of the pharynx, there is no harm to be dreaded from the incision above described. Were the instrument carried far upwards and backwards, the internal carotid would be in danger; but if its point be pushed straight outwards and forwards, it will sink into the pterygoid fossa, and possibly divide the tensor palati muscle, where it can come in contact with the external pterygoid process only. Next I pare the edges of the fissure with a straight, blunt-pointed bistoury, removing little more than the mucous membrane; then, with a pair of long, blunt-pointed curved scissors, I divide the posterior pillars of the fauces, immediately behind the tonsil, and, if it seems necessary, cut across the anterior pillar too; the wound in each part being about a quarter of an inch in extent. Lastly, stitches are introduced by means of a curved needle set in a handle; and the threads being tied, so as to keep the cut edges of the fissure accurately in contact, the operation is completed."

There are many precautions on the observance of which the success of this operation will in a great measure depend. Some of these are, that the general health be good—that the patient has attained an age to understand the necessity of remaining tranquil, and of making as little movement of parts as possible during and for some days after operation—that previous to operation the parts be accustomed to the contact of instruments—that the muscles be perfectly divided, so as to put the parts into a state of complete repose—that all bleeding should be allowed to cease before the introduction of the sutures—that the sutures be not drawn too tight, lest they should cause ulceration, or cut their way through, or produce tension when the slight swelling of parts supervenes, the operator remembering that no undue traction should be made upon the parts, and that the object of the sutures is "to hold and not to draw the parts together"—that speaking should be interdicted—that nourishing food in a fluid state should be cautiously swallowed—that no solid food should be given until perfect union has taken place—that the sutures be not disturbed for eight or ten days—and that they should be cut across with a pair of scissors and drawn out in their order from above downwards. That it was most fortunate that the happy thought occurred to Mr. Fergusson to divide the muscles, is proved by the great success of the operation. Mr. Fergusson has operated 55 times, and been successful in all but 2. Among many others who have performed this operation with success may be mentioned Mr. Tatum, Mr. Avery, Mr. Quain, Mr. Gay, Mr. Bowman, Mr. Walton, and Mr. Browne of Belfast.

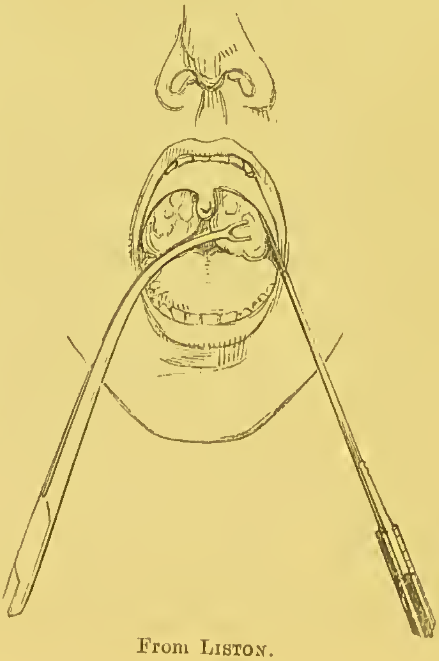
Mr. Pollock has not only practised with success Warren's operation, already described, for closing openings in the hard palate, and facilitated its performance by the invention of suitable instruments for the purpose, but he has made a modification of the manner of dividing the levator palati, which makes the carrying out of this part of Mr. Fergusson's suggestion much more easy than by Mr. Fergusson's method. He passes a ligature through the corner of the palate to enable him to draw it forward and to the opposite side; he then sends a narrow-bladed knife from before backwards through the soft palate at the inner side of the hamular process, and by raising and depressing the handle, fulfils in the most simple, easy, and certain manner Mr. Fergusson's all-important indication, to divide the levator palati muscle. Mr. Pollock has operated with great success, and nothing could be more perfectly satisfactory than the result in some of his cases which he had the kindness to show to me. Mr. Browne of Belfast has also drawn particular attention to this subject, and published some excellent papers upon it. He has operated successfully in a considerable number of cases, one of which I had the gratification of seeing in Belfast. Mr. Browne divides the levator palati from behind, according to Mr. Fergusson's method; but if any tension or motion be discoverable after the ligatures are tied, he removes it by sending a narrow knife through the palate from before backwards, in the situation recommended by Mr. Pollock; he introduces the ligatures very easily and quickly by means of a porte aiguille; he uses a double ligature, and ties it by a very nice method, quite different from the mode of tying the common suture, and also from the mode which commences with a running knot on one end of the ligature through which the other is drawn.

ABSCESS OF THE TONSIL, AND CHRONIC ENLARGEMENT OF THE TONSILS.

It is not unfrequently necessary to open an abscess in the tonsil. For this purpose some use a lancet enclosed in a sheath; but I have uniformly employed the instrument used by Professor Fergusson and many others, namely, a straight bistoury enveloped in lint to within about half an inch of the point. The important precaution to be observed is, to keep the point of the instrument directed backwards and not outwards, lest the internal carotid artery should be endangered.

Chronic enlargement of the tonsil not unfrequently takes place to such an extent as to cause narrowing of the isthmus faucium, giving rise to difficulty of swallowing and breathing, and indistinct, disagreeable articulation. The disease consists of simple hypertrophy, and when it

Fig. 283.



From Liston.

does not yield to proper treatment, the judicious proceeding is, to shave off the tonsil on a level with the folds of the velum.

The patient being placed opposite a good light, and the tongue depressed, the surgeon seizes the tonsil with a vulsellum, and then applies the long, narrow, blunt-pointed knife to the under part of the tonsil, and by a gentle sawing movement, shaves it off on a level with the folds of the velum. In removing the left tonsil, it will be convenient to hold the vulsellum in the left hand, and the knife in the right; and in removing the right tonsil, to hold the vulsellum in the right hand, and the knife in the left. I have never seen much hemorrhage after this operation, and have invariably found it most satisfactory in its results.

For removing a part or the whole of the uvula, a spring forceps or vulsellum for seizing, and a pair of curved scissors for cutting, answer as well as any instruments that could be desired.

THE LARYNGOSCOPE AND ITS CLINICAL APPLICATION.

When I was about to send this sheet to press, the following description of the laryngoscope appeared in the "Edinburgh Medical Journal:"—

"Physicians have long endeavoured to facilitate the means for physical diagnosis in those diseases situated in localities of difficult access. The Academies of Medicine in France have very recently discussed the merits of an apparatus intended to illuminate the openings of the principal cavities in the body. We can recollect the attempts made even to illuminate the interior of the urethra; and now we have an instrument brought forward for the exploration of the larynx and such parts of the pharynx as are inaccessible to ordinary inspection.

"This method of examination, of which the first employment seems to date back several years, originated in Germany. In 1855, M. Garcia had an instrument constructed for the same purposes as those now under notice, and even named it the *laryngoscope;* but, owing to the results obtained by it being unsatisfactory, it was very soon abandoned as useless; and it is only since 1857 that, owing to certain practitioners in Germany having devoted their attention to the subject, and having made numerous experiments towards the perfecting of an apparatus of the kind, an instrument has been produced capable not only of assisting the diagnosis, but of serving to guide the hand, and otherwise assist in the treatment of disease of these parts.

"It is chiefly to the labours of MM. les Docteurs Turck, of the General Hospital at Vienna, and Czermak, professor of physiology in the University of Pesth, that we owe the principal facts ascertained in regard to such appliances and their construction; while their first practical application as adjuvants in clinical medicine has been made by MM. Semeleder, Stoerk, Gerhardt, and some others.

"The instrument used by M. Czermak consists of a small mirror, square or oval, or even round in shape, and having a handle fixed to it at one corner or side. The size of the mirror should correspond with the size of the parts to be examined; but between 15 and 30 millimetres, or perhaps an average size of 20 millimetres in diameter, is the dimension suited for the majority of cases. The thickness of the mirror should be about 2 millimetres, as any smaller size is apt to become cool, and to have vapours condensed upon its surface, and so lead to inconvenience during its use. The handle should be about 8 or 9 centimetres long, and so flexible that it may be adapted to the parts, and yet not be liable to bend during its application. The most important point is the mode of obtaining a sufficient amount of light during this process; and in order to do so, M. Czermak does not depend upon the light of the sun, as others have done, but adopts the method of artificial illumination employed by Professor Helmholtz in ophthalmoscopic operations.

"The mode of procedure in using this instrument is as follows:—The patient is seated in front of the operator; the hands resting on the knees, the body inclined forward, the head thrown back, the mouth widely opened, and the tongue as much depressed and flattened as possible. The operator sits *vis-à-vis* with the patient, and grasps the knees between his, having taken care to place the patient in the fullest light of a lamp placed upon a table at his right hand, the lamp having a beak or neck, as in the ophthalmoscopic apparatus, which shall throw a vivid stream of light into the back part of the mouth.

"The next stage in the procedure is to introduce the mirror, sufficiently warmed and adapted to the part desired to be examined. In order to effect this, the patient is told to take a deep inspiration, and emit the sound of the letter ê alternately. During this manœuvre the mirror is introduced under the velum palati, thus raised for the moment, and then directed so as to suit the position of the part to be inspected. This process, which is that recommended by Gracia, has been improved by Czermak, who, besides the reflecting mirror, adds an illuminating one, with an opening in its centre, through which the eye of the operator is directed; and this second, or illuminating mirror, is fixed either round the head of the surgeon, or in the manner of a pair of spectacles, or held between his teeth—the latter being the plan followed by Czermak.

"Laryngoscopy thus performed by a dexterous and experienced hand —because it requires much experience to acquire facility in its practice—enables not only the deeper portions of the larynx to be examined, but even the bifurcation of the bronchi to be distinguished; and in this manner M. Czermak has diagnosed cases, where hoarseness was supposed to be of a nervous nature, to be cases of organic disease of the vocal chords, etc., etc.

"The following are a few of those cases in which this instrument has been lately employed with decided advantage, and as a fully recognised adjuvant to our means of medical diagnosis :—

"1st. At the Hôtel-Dieu, M. Trousseaux has employed it in several cases, and also in his private practice.

"2nd. At the Hôpital St. Antoine, M. Lasègue has adopted its use.

"3rd. At the Hôpital de la Charité it is employed by M. Beau.

"4th. At the Hôpital des Enfans, by M. Bouvier.

"5th. At the Hôpital du Val-de-Grace, by MM. Michel, Levy, and Champouillon.

"6th. At the Hôpital Lourcine, by M. Désormeaux.—*Gazettes des Hôpitaux*, March and April, 1860.

"[The late eminent surgeon, Mr. Liston, had also, many years ago, directed his attention to the construction of an instrument for the examination of the larynx.]"

DISEASES OF THE THROAT, EPIGLOTTIS, AND WINDPIPE.

For an instructive account of all that it is important to know regarding the diseases of this region, I beg to refer the reader to a clear and exceedingly able work on "Diseases of the Throat, Epiglottis, and Windpipe," just published by Dr. Gibb. The symptoms, pathology, and treatment of the numerous affections are described with remarkable clearness, within reasonable limits; and as Ryland's work on these subjects has long been out of print, Dr. Gibb's treatise supplies a deficiency, and conveys much information of the greatest practical importance. Some of the numerous affections described by Dr. Gibb are—Follicular disease of the throat and air-passages—chronic disease of the windpipe—displacement of the cartilages—ulceration—destruction and ultimate exfoliation—lesions of the epiglottis—suppression and loss of voice—the sore throat from oratory, public speaking, and singing—ossification and calcification of the cartilages—saccharine throat—nervous sore-throat—hysterical affections of the throat—laryngismus stridulus—diphtheria—croup—acute laryngitis—œdema of the glottis—erysipelas of the windpipe—sore-throat from gout and scarlet fever—rubeola, from tobacco and syphilis—polypus of the throat—polypus and other tumours of the windpipe—dislocations and fractures of the os hyoides, hitherto undescribed, and for the first time considered—and fractures of the cartilages of the larynx. This simple enumeration of many of the affections described by Dr. Gibb will show that it is impossible, in a systematic work on surgery, of ordinary limits, to give satisfactory information on these diseases. Some of these diseases are of especial interest to the surgeon, on account of their requiring topical medication; and others, from their demanding the operation of tracheotomy.

Application of a Solution of Nitrate of Silver.—At the present day, common consent and experience have given the preference to the solution of the nitrate of silver as the most important and useful means of topical medication. By means of the sponge and whalebone, it can be directly applied around the base of the epiglottis, or to the lips of the glottis, or to the interior of the larynx, or to any part of the throat, as the circumstances may demand. My own experience leads me fully to agree with Dr. Green and Dr. Gibb, that a solution of less strength than from two to four scruples of the salt to an ounce of distilled water should rarely be used, and that, if the object be to arrest ulcerations upon the epiglottis, or about the opening of the larynx, a stronger solution may be employed with advantage. The application of the solution within the larynx is often beneficial in cases of ulceration from any cause; obstinate hoarseness and loss of voice; or diseases of a prolonged asthenic or irritative character. The great value of this practice has of late years been strongly advocated by Trousseaux, Horace Green, Warren, and others; and the general belief at the present time is, that without this mode of local medication, it is impossible to bring many affections of the glottis and larynx to a satisfactory termination. In ordinary cases, the best and most effectual mode of applying the solution is, to depress and bring forward the tongue with a curved spatula, and to pass the sponge on the curved whalebone, probang into the glottis. The frequency of application will depend upon the amount and duration of the disease, and the effects it produces. When the object is to introduce the solution freely, and with certainty, into the interior of the larynx, I always prefer the laryngeal syringe. The instrument having been charged, its bent silver tube, perforated by many foramina at its distal extremity, is introduced into the glottis, and then, by a gentle movement of the piston, the fluid is freely thrown, by numerous jets, into the interior of the larynx, without the slightest difficulty. For applying the solution to the epiglottis and all parts around it, and to the glottis and all parts above it, the best contrivance, as already stated, is the curved whalebone sponge probang, or as the instrument is often called, the throat sponge; but, when the object is the application of the solution to the cavity of the larynx, the laryngeal syringe will be found so suitable, that no better mode could be desired. Judging from my own experience, I cannot but feel surprised that there could be any diversity of opinion as to the ease with which the solution can be applied to all the parts mentioned above, or as to the comparative merits of the two modes of application, or as to when the preference should be given to the one method and when to the other. But, while I hold my opinion on these subjects as strongly as I do any on surgical points on which there exists no diversity of opinion, and while I think Dr. Green especially, and other able practitioners, have done an incalculable amount of good by demonstrating the great benefit of cauterization in many diseases in the above easily accessible situations, I think, with many others, that it would have been well, that proposals had never been made or proceedings instituted to carry the operation further, and to convey the probang or other instrument into the trachea, the bronchial tubes, and pulmonary caverns, for the purpose of cauterizing these parts. While deeply impressed with the consideration that much may be accomplished by the dexterity, skill, and experience of one possessed of these qualities in a high degree, yet physiological and other considerations lead me, with many, to doubt the possibility of sponging and mopping out the trachea and lower parts of the respiratory canals, and of applying a caustic solution to them. If the probang, saturated with caustic solution, has ever been passed between and below the vocal chords, I cannot but think it has been so, much seldomer than some have made themselves to believe. The evidence of the New York Academy is of great interest on this subject. Many patients submitted to be operated upon, with the view of having it settled by experiment, whether or not the probang or other instrument could be passed into the trachea for the purpose of cauterization. The sponge probang and two tubes, the size of a No. 10 catheter, were used in these experiments. One tube, slightly bent at the extremity, was selected by Dr. Green, and was of the shape used by him in practice; the other was a flexible catheter, with a wire stilette, having a curve, the segment of a circle six inches in diameter. Some of the results were, "that Dr. Green failed in passing the tube with the small curve in 35 out of 38 trials, or in about 92 per cent. of the cases; and that the tube with the large curve was passed in 8 out of 13 cases; whilst the sponge probang failed in every case (18) in which it was tried." In two instances in which Dr. Green was positive that he had passed the tube into the trachea, the patient vomited through the tube, and thus demonstrated his error, and at the same time showed, that the sensations of one of large experience furnish no reliable information as to the course taken by the tube. The conclusion arrived at by the commission was—" That there is no reliable evidence that the sponge probang has been ever passed through and beyond the vocal chords."

FOREIGN BODIES IN THE LARYNX AND TRACHEA.

Varieties of situation and symptoms.—A piece of food sometimes gets into the rima glottidis, and causes instant death; in other instances, the foreign body gets beyond the rima glottidis, and produces different symptoms, according to its situation and other circumstances. When it remains in the ventricles of the larynx, or upper part of the trachea, the usual symptoms are, difficulty of breathing, loss of voice, spasmodic cough, a fixed pain referred to a particular spot, and a croupy sound during respiration. When the foreign body is loose in the trachea, the patient is severely distressed at first with violent coughing and a sense of suffocation; but afterwards these attacks become only occasional, and during these paroxysms the body has often been heard, by means of the stethoscope, striking against the larynx, and distinctly felt by the patient. In the bronchi it gives rise to a fixed pain, and to a whistling or murmuring sound.

FOREIGN BODIES IN THE AIR-PASSAGES.

Mortality caused by Foreign Bodies.—Dr. Gross has published many interesting statistical facts regarding 159 cases in which foreign bodies had passed into the air-passages. Of 159 cases, spontaneous expulsion took place in 57, 8 terminating fatally. Inversion of the body alone was successful in 5 cases, and unsuccessful in 6. In 68 cases, tracheotomy was performed, and of these 60 lived, and 8 died. Of 17 persons upon whom laryngotomy was practised, 13 lived, and 4 died. In 13, laryngo-tracheotomy was performed, and of these, 10 recovered, and 3 died. It appears that of the 98 cases in which the windpipe was opened for the removal of foreign bodies, 83 were successful, and 15 fatal. The deaths were thus in the ratio of 1 to 5½. Of the 3 operations performed, tracheotomy was followed by the most favourable results, the deaths being only in the proportion of 1 to 8½; whereas, after each of the other two operations, the proportion of deaths was twice as great. The most frequent cause of death was inflammation of the lungs.

Treatment.—A foreign body having entered any part of the laryngo-tracheal canal, the indication to be fulfilled is, to get it removed as speedily as possible. The proceedings for that purpose must vary according to the situation of the intruder. A body of considerable size, such as a bit of meat, may pass into the larynx, and a portion of it may project upwards into the pharynx. If death has not taken place before the arrival of the surgeon—which has been the case twice in my own experience—life may be saved by introducing the pharynx forceps, laying hold of the foreign body, and removing it. If fixed entirely within the larynx, the proper proceeding consists in performing tracheotomy, inserting a flexible tube into the wound on pushing the body upwards into the pharynx. If the foreign body be below the larynx, and moveable, the preferable practice consists in inverting the body, which may be done in the case of a child, by holding the body, and depressing the head, neck, and chest; and in the case of an adult, by fixing the body to a couch, or any convenient apparatus, and, after inversion, to direct the patient to cough, by which means the substance, in many instances, is forcibly ejected. Some recommend that the patient be first narcotized, to take off the spasm of the glottis, and then inverted; but if the narcotism be very decided, the patient may not be able to make the exertion of coughing, and the proceeding of placing the body in the inverted position may bring on symptoms of suffocation. When this proceeding is unsuccessful, it is justifiable then to perform tracheotomy, which may be required to prevent suffocation; but when not immediately demanded for that purpose, it may be undertaken with one or other of the following objects:—1. As a precaution lest sudden suffocation should take place; 2. To admit of the introduction of some or other of the various kinds of forceps for the extraction of foreign bodies from the air-passages; 3. To take off spasm from the larynx, and thereby facilitate expulsion by coughing, when the body is inverted. As soon as an artificial opening is made, the spasm of the larynx ceases directly, and extrusion is thereby facilitated. The celebrated case of Mr. Brunel is very interesting in reference to this point. Inversion was tried, but was discontinued, in consequence of its bringing on distressing cough and most alarming suffocation. The trachea was then opened, but the foreign body could not be found. Sixteen days afterwards, Mr. Brunel was fixed to a board moveable on a hinge in the centre, to admit of inversion; the body was inverted; he was forcibly struck between the shoulders, and directed to cough, when the half sovereign was forcibly ejected through the glottis.

Laryngotomy and *Tracheotomy* are terms applied, as their derivations indicate, to certain operations by which an artificial opening is made into the larynx and trachea respectively, for the purpose of admitting sufficient air to the lungs, when the natural entrance is closed or obstructed by disease, tumefaction, spasm, or impaction of foreign matter, so as to threaten death before the obstruction can be relieved by other measures, and for the purpose also of removing foreign bodies from the larynx, trachea, or bronchi. Both these operations are frequently referred to under the general name of Bronchotomy, which implies cutting the windpipe, without specifying any particular situation.

Foreign bodies of various forms occasionally enter the windpipe during inspiration, and more especially when this act is performed simultaneously with that of deglutition. These bodies are sometimes expelled by the convulsive coughing excited by their presence in the air-passages, after having remained, in some instances, for weeks, months, or even years; but in most of these cases, serious organic lesions of the lungs are induced by the long-continued irritation and inflammation which accompany their presence, and frequently continue after they have been thus expelled, so that life is, under these circumstances, usually very much abridged. In all such cases, therefore, it is proper to operate after the other proceedings mentioned above have been fairly and skilfully tried, and found ineffectual; and if possible, before inflammation supervene. The presence of the body in the windpipe will be known, partly from the history of the case, partly from the signs and symptoms present or absent; and partly by ascertaining, by the fingers or some suitable instrument, that it is not in the pharynx. If it be found in the latter situation, it may frequently be withdrawn by the fingers; when in the upper part of the œsophagus, it can generally be removed by suitable forceps; or, in some cases, when it is far down the gullet, and is of a digestible or at least not of an irritating character, it may in preference be pushed downwards to the stomach by the gentle use of the probang. But when the body, though situated merely in the pharynx, is so tightly fixed that it cannot be instantly withdrawn, while, by pressure on the epiglottis, or on the larynx from behind, it threatens instant death from apnœa, then tracheotomy must be first performed, so as to maintain the respiration, and permit the foreign body to be extracted with sufficient deliberation and safety.

The operation is also specially advisable in œdema of the glottis, whether acute and sudden, or chronic and slow in its attack; and either with or without chronic ulceration, or other disease of the larynx. It is also proper in idiopathic and traumatic inflammation of the larynx, when suitable remedies fail to give relief, or at least fail to do so in time. The operation of bronchotomy is not performed in these cases with the view of curing the disease, but only of counteracting one of its effects: its object is, to prevent the arrest of respiration by a mechanical cause, until the disease, which has given rise to the obstruction, shall have yielded to nature and suitable treatment. But undoubtedly the operation, if performed at a proper distance from the seat of the inflammation, assists in subduing its violence, as it temporarily relieves the glottis and upper part of the larynx from performing their usual functions in the act of respiration; and by the local rest and relaxation thus afforded, the decline of vascular action is certainly favoured. The ultimate success of the operation depends very much on the period at which it is performed; and it should never in these cases be delayed a moment after it is plainly seen that respiration is likely to be affected, or after the signs of deficient aeration of the blood are observed in the commencing duskiness of the countenance and lividity of the lips. It is much more successful when the threatened apnœa is sudden in its attack, than when it slowly and gradually supervenes during disease of considerable duration.

In croup, a disease in which the trachea, and very frequently the bronchial tubes, even to their smaller ramifications, are affected, this operation affords little prospect of success; but it has succeeded in a few cases, apparently the most desperate, and may, therefore, be occasionally advisable as a last resource. Although a patient is now and then saved, experience has shown that the result of tracheotomy in croup has generally been what the pathology of the disease would indicate as all but certain. Trousseaux has strongly advocated the operation, and published a considerable number of successful cases. In the Hospital for Children in Paris, it was performed 215 times in five years, and 47 of the patients were cured. Of 351 patients operated upon by the most distinguished surgeons in France, 312 died, thus giving a ratio of 8 deaths to 1 recovery. Mr. Porter, in his most admirable work on the Larynx and Trachea, from the perusal of which I have derived the greatest pleasure and much information, condemns the operation in cases of croup. In diseases affecting the lungs alone, it is of course useless; but even in these, when the immediate cause of danger is referable to some laryngeal complication, life may be prolonged by the operation, a few hours, or perhaps even a few days. Tumours connected with the larynx or trachea, either internally or externally, and even when at some little distance from the air-tube, sometimes interfere so materially with respiration, either by the mechanical obstructions they present, or by the frequent irritation and spasm of the glottis which they excite, as to render tracheotomy justifiable and necessary. In cases of suspended animation, whether from immersion, strangulation, hanging, or from inspiring an impure atmosphere or noxious gas, opening the air-passages was at one time believed to afford the only chance of recovery, by the quick and easy manner in which it permits the establishment of artificial respiration, and the insufflation of pure air. In instances of drowning, strangulation, and hanging, artificial inspiration is now maintained by Marshall Hall's proceeding, without having recourse to operation, and is found much more satisfactory and efficient.

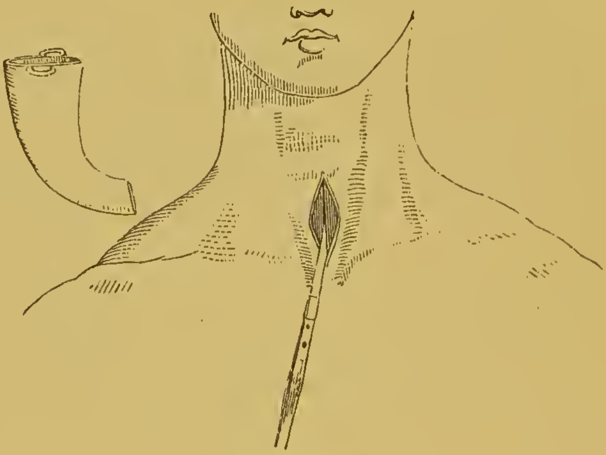
Laryngotomy can be performed with much greater safety, speed, and facility than tracheotomy; but with the single exception of cases in which a foreign body is lodged in the larynx, and for the removal of which a forceps is not necessary after opening the larynx, there scarcely is a condition in which tracheotomy should not be preferred. Tracheotomy is a more tedious and delicate operation, and is more exposed to accidental dangers from hemorrhage, and from unusual position of blood-vessels, than laryngotomy; but except in the single condition mentioned above, it ought to be preferred. Some also prefer laryngotomy in cases of inflammation of the glottis caused by scalding, and they do so on the ground that the inflammation rarely descends below the vocal chords.

Three situations have been recommended for the operation of laryngotomy; but it should be restricted to one of them, namely, the cricothyroid membrane. The operation is exceedingly simple, and may be performed in the following manner:—The head is bent back a little, so as to stretch the integuments in front; the depression between the thyroid and cricoid cartilages is felt for; and a vertical incision of an inch or so in length is made in that situation, exactly in the mesial line. By this stroke, the skin, superficial fascia, and the fibrous tissue between the margins of the sternohyoid, sternothyroid, and cricothyroid muscles, may be divided. These are to be drawn a little to one side, which proceeding will be facilitated by bringing the head slightly forwards. The cricothyroid membrane may then be pierced by the point of the knife, which, after having entered and divided the membrane from above downwards, should be partially withdrawn, and its edge turned quarter round, and passed in again so as to cut transversely, making in this manner a crucial opening. Or the membrane may be pierced by a trocar. There is usually very little bleeding after this operation, although a small branch from the superior thyroid artery of each side runs across the membrane. If necessary, a laryngotomy tube of suitable size may be introduced.

Tracheotomy is sometimes rendered a dangerous operation by the unusual distribution or course of arteries or veins, which occasionally are of no mean size. Before commencing the operation, however, the surgeon will be able to ascertain by his finger whether any large artery is in the way, and so be prepared to avoid or secure it, as the case may require.

If the object of operation be to remove a foreign body, there should be at hand one or more long metallic probes, which can easily be bent to any form, with a plentiful supply of long and short forcipes of various forms and curves, having the limbs so adjusted that some may open laterally, and others in the antero-posterior direction, and constructed with points adapted for seizing the object to be extracted. In addition to these instruments, there should be a small sharp hook, and a curved "tube of a conical shape, and flattened laterally," as recommended by Mr. Liston. The patient should be placed in a good light, with the trunk and head raised, the front of the neck made tense by the head being drawn back, and steadied by the hands of an assistant. A small scalpel is employed in the cutting part of the operation, which consists, in the first place, in making an incision exactly in the mesial line through the skin and superficial fascia from the lower margin of the cricoid cartilage downwards, nearly to the top of the sternum. Any blood-vessel now seen must be drawn downwards, or aside, and each margin of the cutaneous wound retracted a little. Any loose cellular and fatty tissue present should now be carefully cut through, but still in the mesial line. The deep cervical fascia, which covers and connects the opposed margins of the sternohyoid and sternothyroid muscles, must next be divided along the centre of their line of junction by the point of the scalpel; and the neck being now somewhat relaxed, these muscles are separated and drawn a little apart by the handle of the instrument, and by the finger, which is employed at the same time to discover, by pulsation, the presence of any unusual artery. Any vessels here found, whether arterial or venous, must be drawn out of the way, and the cellular tissue cleared off in the central line by the finger, or the handle or the point of the scalpel. The isthmus, or central slip of the thyroid body, should be drawn upwards without being wounded, because, especially when unusually thick, it might furnish a troublesome

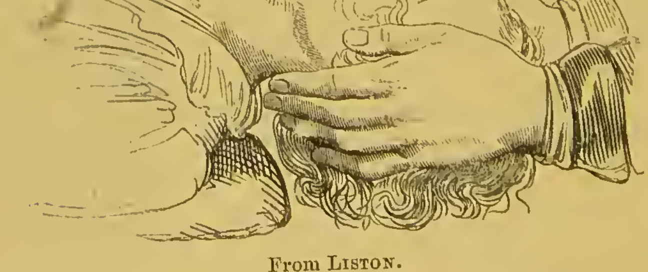
Fig. 284.



From Liston.

quantity of blood. At this stage, if there be much hemorrhage, and the case be not one of urgent haste, it will be necessary to delay the opening of the trachea for a few moments, until the bleeding be arrested by means proportioned to its amount and character; but when possible, as it generally is when the mode here recommended is followed, it is better to finish the operation at once. For this purpose, the upper part of the trachea is seized by the sharp hook already

Fig. 285.



From Liston.

mentioned, and by it is drawn up and held steadily. In either case, at the instant when the windpipe is drawn up to its utmost, the point of the scalpel having its back directed to the sternum is introduced into the lowest portion of the exposed part of the trachea, and is carried upwards so as to divide, in its course, three or four of the rings in the central line.

If there be oozing to any considerable extent, the trunk and neck of the patient should be inclined forwards, so as to favour the outward escape of the blood and prevent its flowing backwards into the trachea. At the moment when the air first rushes in, a curious and distressing sensation of anxiety and alarm is experienced; but this speedily subsides. If the operation was undertaken for the purpose of removing foreign matter, this should now be proceeded with. The patient's sensations usually refer its situation pretty correctly to a distinct spot; and the auscultatory signs will confirm or correct the impression as to its precise locality. The probe should now be employed, so as to discover more exactly the direction and distance of the object from the external opening; after which a forceps of suitable form is to be cautiously introduced, and the body extracted. Subsequently, a tube, of the shape before described, which compresses the bleeding margins of the wound, and stops the oozing, should be introduced, until the oozing has completely ceased; after which it may be removed, and the wound allowed to heal of its own accord.

Many different kinds of tubes have recently been constructed, which I need not describe; but it is important to use a double tube if there be expectoration from whatever cause. The inner tube can be taken out and cleaned without causing any inconvenience to the patient. Many different modes of performing tracheotomy have been proposed during the last few years. Some of these methods are by a bent tracheal trocar and canula, a proceeding partaking of the character of a plunge, and liable to the objection that the trachea becomes depressed, and is not easily penetrated by the instrument. This proceeding, in my opinion, should never be adopted. M. Garin of Lyons contrived an ingenious instrument for opening the trachea and keeping the edges asunder until the tube is introduced, or other objects accomplished. That excellent surgeon, Mr. H. Thompson, has devised an instrument with two blades, united by means of a hinge at one end, and bent down at an angle at the other, and furnished with cutting edges. The points are introduced transversely, between the first and second rings of the trachea, and by means of a screw the blades are separated from each other, and a sufficient opening made for the introduction of the tube. If an object of the operator be to allow of the introduction of a forceps, the transverse opening will be found much less convenient than the vertical. The late Marshall Hall contrived ingenious instruments for cutting out a portion of rings of the trachea to keep the part constantly open. This suggestion was for carrying out his view of having a constant opening for the admission of air to the lungs in cases of epilepsy, so as to free the patient from the present and future consequences of the spasm of the glottis in attacks of that complaint. For my own part, I think tracheotomy should always be made a dissection, and I prefer the method first described to every other. I have often demonstrated on the dead body all the above-mentioned methods, and described the whole of the different kinds of instruments, but in the living body I always prefer the simple dissection.

RANULA.

Ranula is a swelling or enlargement of the sublingual gland, generally ranging in size from that of a small nut to that of a pigeon's egg, and is caused by retained secretion consequent on obstruction of the excretory ducts. The swelling is usually more or less oval in figure, has a translucent appearance, and contains a fluid, which, on some few occasions, is extremely thick and pultaceous, at other times very thin and watery, but usually of a more or less glairy appearance, and of a consistence similar to that of the white of eggs. In some instances, gritty, calcareous particles are found in the contents of the enlarged gland. The disease occurs at all periods of life, and usually causes little or no disturbance, until, by its size, it materially impedes articulation or deglutition.

This disease has been removed by various operative proceedings. Some surgeons recommend and practise excision of an oval portion of the flap, allowing the resulting wound to heal by suppuration and granulation; others, again, have succeeded in effecting a cure by passing a seton through the enlarged gland; and others have successfully practised puncturing the tumour and injecting it with tincture of iodine. By some one or other of these proceedings, the disease may in most cases be removed, provided the tumour be of moderate size, and its contents fluid; but in many cases where the gland has become of very large dimensions, and its contents of a solid consistence, excision of the entire gland can alone be resorted to with the hope of affording permanent relief.

GLOSSITIS.

Glossitis, or inflammation of the tongue, is either a primary disorder, consequent on wounds, scalds, or burns of the organ, or a secondary affection caused by extension of inflammation from the palate, tonsils, or other glands. Again, more or less severe glossitis always exists in those cases where mercury has produced a powerful impression on the system.

In well-marked cases, the tongue becomes extremely tender and enlarged; in some cases, the swelling is so great, that the organ completely fills the mouth, protruding more or less beyond the lips; and in all cases of any severity, there is extreme difficulty or inability to swallow, and great embarrassment in the breathing. When the disease is consequent on ptyalism, the tongue is intolerably painful, very red, and presents at one part patches of lymph, and at another, small unhealthy little ulcers.

The treatment of glossitis consists in venesection, topical depletion, purgation, or, in one word, in the antiphlogistic treatment in all its details. Great relief is often experienced from the continuous application of ice to the inflamed organ. In cases partaking of an erysipelatous character, some recommend painting the tongue with a weak solution of iodine, or a strong solution of nitrate of silver. When suffocation threatens, owing to the great size of the swelling, or when suppuration occurs as a result of the inflammation, deep incisions into the substance of the organ require to be made for the relief of distended vessels, and the exit of effused fluids.

In glossitis consequent on ptyalism, mild purgatives must be regularly exhibited, and weak astringent gargles of tannin, alum, sulphate of zinc, sulphate of copper, or sulphate of iron, assiduously employed. When the tongue is ulcerated, the local application of a strong solution of nitrate of silver is frequently very beneficial. Chlorate of potash may often be very advantageously employed, both locally and constitutionally, in cases of glossitis acompanying ptyalism.

HYPERTROPHY OF THE TONGUE.

Hypertrophy of the tongue is generally congenital, but, in some few instances, it is met with as a result of previous inflammation. It has been found associated with arrested or imperfect development of the lower jaw. In general hypertrophy of the tongue, the papillæ become enormously developed, the mucous membrane becomes extremely thick and leather-like, and the muscular structure acquires a very rigid and indurated character. The whole organ becomes very thick, and much enlarged in the progress of the disease, protrudes more or less beyond the teeth, causes a constant flow and dribbling of saliva, and occasions much distortion of the features, as well as impediment to mastication, deglutition, and articulation. The disease is generally very slow in progress, and occasions considerable derangement of the general health.

When hypertrophy of the tongue is a consequence of inflammation, and when it is of slight degree, and not of long standing, benefit may at times accrue from judicious antiphlogistic treatment, comprehending low diet, purgatives, alterative doses of mercury, or a course of the iodide of potassium.

When the disease is congenital, the most likely means of affording relief are, the application of leeches from time to time, the systematic employment of strongly astringent lotions, and the practice of punctures or incisions at proper times. Gross mentions that benefit resulted to a case under his care from the regular employment of a lotion of pyroligneous acid of the strength of a drachm of the acid to the ounce of water.

Lassus and Syme have recorded cases where much good followed the systematic employment of compression by means of a bandage. If all these means fail to ameliorate or remove the disease, the only other possible alternatives are the knife or the ligature.

The tongue is subject to cancer, for which partial and complete removal have been practised. From the partial excisions in the practice of others, and in my own, I have seen no ultimate benefit; and after the experience now obtained of complete excision by any of the methods hitherto practised, it appears to me that an operation for that purpose ought no longer to be considered justifiable. I therefore think it unnecessary to describe the different proceedings.

BRONCHOCELE, OR GOÎTRE.

This disease consists of an enlargement or swelling of the thyroid gland, which sometimes attains an enormous size, becoming, as the poet says, "a hideous wallet of flesh." Fortunately for those afflicted with it, there is no experience of pain, though, in some rare cases, there is of great inconvenience, when they are obliged to crawl on the ground on account of the extreme weight of this appendage.

It does not appear that the disease is communicable by contagion or by infection. It is hereditary. The child, on reaching puberty, in many instances does not escape, if the parents are affected.

There are certain spots in which it prevails, in which it exercises a sad and universal sway. In England, it is found in Derbyshire, Yorkshire, especially in the limestone district of Craven, Nottinghamshire, Somerset, Surrey, Hampshire, &c. In the western hemisphere, it is found in South America; and in Oriental parts, in Sumatra. The valleys of the Alps, in the midst of all the surrounding magnificence, present this, an unsightly contrast to the grandeur of the scene. On the north of the Alps, the women are more affected than the men; while at Dommo d'Ossola, the men are more affected than the women.

It does not occur in every valley, nor in every part of the same valley. In one spot it may prevail, while another, a little higher up, enjoys exemption; but again, it may appear at the distance of a mile or two. It is found on one side of a valley, and not on the other, according to the testimony of Sir Astley Cooper, who visited Martigny in 1834, with a view to investigate the subject.

Various theories have been proposed to account for the existence of this disease. Of these, several are evidently unworthy of consideration. The carrying of heavy burdens on the head will not account for it. The use of snow-water or of spring-water impregnated with calcareous matter will not account for it. The indulgence of filthy habits will not account for it; nor will the nature of the soil.

The only view which seems satisfactory is that which refers it to the state of the atmosphere. Where the sides of the valley are so clothed with wood, or where so sudden a bend in the direction occurs, that free ventilation is hindered, there goître prevails, more especially if the bottom is subject to the overflowing of a river, or to extensive irrigation. Low, warm, moist situations, at the bottom of valleys, where there is a stagnation of water and of air, are favourable to the production of goître. In accordance with this view, it is found that the children of goîtred parents, if born and brought up on elevated spots, at a distance from home, often escape the disease.

Two years ago I went to all the principal valleys of the Alps where bronchocele prevails, and saw thousands of cases; and it seemed to me perfectly evident, for reasons I cannot afford space to mention, that the only satisfactory cause of the disease is the one mentioned above. Sometimes these enlargements are simple hypertrophies, the tissue being close and uniform ; but very often it is due to a jelly-like or colloid matter, which is sometimes fluid, and, in other instances, firm like wax. The only treatment I have ever seen of benefit in the examples of bronchocele in this country is that for the scrofulous diathesis, carried out very energetically in all its details, together with the use of iodine, both externally and internally. Three operations have been practised for the cure of this disease—namely, a seton, ligature of arteries, and extirpation. All have, in some cases, proved fatal, and the results do not justify the adoption again of any of these proceedings.

CHAPTER XXVII.

AFFECTIONS OF THE BREAST.

Acute Inflammation of the Breast.—This is a disease of very rare occurrence, except during the period of lactation, the active state of the gland then rendering it very susceptible of influences causing inflammation. These exciting causes may be general or local. To the former class belong irregularities of diet, cold, mental emotions, or any circumstance calculated to produce a decided impression on the system; and to the latter, contusions, external injury, the direct application of cold, and too long retention of milk. The local symptoms are those usual in inflammation of a very aggravated form, together with diminished secretion of part of the gland, and suspended secretion, if the whole of the gland be inflamed. When the inflammation is very acute, resolution is rarely obtained, unless the treatment be early and energetic; and the result most apt to take place is suppuration, the matter forming an abscess called a milk abscess in the breast. The constitutional disturbance is great, and usually commences with a rigor. The object aimed at by treatment in the first instance should be to obtain resolution. With this view all exciting causes should be removed; saline purgatives and antimonials prescribed, and the effect of the latter kept up; the diet restricted, and of an unstimulating nature. With regard to local treatment, support of the breast by means of a handkerchief, leeches, and fomentations, simple or anodyne, are the best remedies in the early stage; but if, instead of resolution, suppuration take place, early, free, and direct incision should be resorted to. By making an early, free, and direct opening, sinuses are prevented, much suffering is spared, and pressure for the purpose of evacuating the matter, which is not only painful but highly injurious, is rendered unnecessary. Warm fomentations and tepid water-dressings, or small poultices, are necessary for a short time; but all relaxing applications should be laid aside as early as possible, and gentle support afforded by means of strapping or gentle bandaging, and a change made to a more generous diet;—for in this, as in many other affections, recovery is sure to be delayed by the long continuance of relaxing applications, or restriction to a diet not sufficiently strengthening.

Chronic Inflammation of the Breast.—The mamma is not unfrequently affected with a slight grade of the inflammatory process, which although attended with little pain, often persists for a long time, and gives rise to enlargement and induration of the breast. This condition is usually symptomatic of some derangement of the menstrual or intestinal secretions, and is most common in females about the middle period of life, who are unmarried, or have not had children. Swelling and slight induration are the principal symptoms, and they generally affect the whole, but in some instances only a part of the gland. There is little pain or tenderness. The swelling is less heavy than that of a genuine tumour, and usually more diffused. These symptoms, and the absence of the signs of the usual tumours of the breast, together with the readiness with which it yields to treatment, are the characteristic marks of this affection. From what has been already mentioned it will be readily understood, that the proper proceeding in these cases consists mainly of constitutional treatment, the aim of which should be to promote a healthy condition of the menstrual and intestinal secretions, and to improve the general health and strength; from the fulfilment of these indications the greatest benefit is found to accrue. The local treatment consists principally in the use of some of the various discutient applications, and in the judicious employment of slight support and pressure by means of strapping or bandaging, chiefly of strapping. The effects of strapping must be carefully watched; but from its cautious use, together with suitable constitutional treatment, the most gratifying results are often obtained. Should the pain be at any time very acute, a few leeches and fomentations may also be employed.

Chronic Abscess in the Breast.—The symptoms of this affection are a swelling, unattended with pain or tenderness, deep-seated, and generally about the size of an egg; the absence of any redness, heat, or swelling of the skin; and in the rest of the gland, the usual characters as to size and consistence. This disease has been mistaken for tumour. The best means for arriving at a correct diagnosis are, the presence of the symptoms mentioned above; the equality of surface of the swelling; the feeling, more or less distinct, of fluctuation on careful examination; and the absence of the usual characters of the tumours of the breast. When the diagnosis is still doubtful, it can be made out by means of the exploring needle or a small puncture: the matter is contained in a firm cyst situated sometimes in the substance of the gland, but more frequently between it and the subjacent muscles. A dependent free opening is necessary; the wound must be kept open and treatment adopted, according to the common principles of surgery, for promoting the filling up of the cavity.

Irritable Mamma, or Neuralgia of the Breast.—This distressing affection is most frequently met with in persons from fifteen to thirty years of age. It does not seem to be confined to any temperament; I have often met with it in females of sanguine temperament, and often in pale cachectic females of nervous disposition, who have suffered from grief and mental anxiety.

In most cases pain is almost constantly felt, but with different degrees of intensity; so that the patient has remissions, rather than complete intermissions of pain. The pain is liable to great exacerbations, some of which are periodical, as, for example, before the menstrual period, when it is often described by patients as being most excruciating. It is often excited also at other times by mental anxiety, and, judging from my own observation, I should say, by any cause, mental or bodily, by which a depressing effect is produced on the system. It is usually diminished during the menstrual period. Tenderness on pressure is another symptom, and is in some cases so great that the slightest touch, and even the pressure of the dress, causes great pain. In many instances, these symptoms are unattended with any enlargement; occasionally, however, there is slight enlargement, but very rarely any alteration of structure; yet sometimes there is the appearance of increased density in some parts of the gland. This neuralgic affection is, in the great majority of cases, regarded as symptomatic of painful or deficient menstruation; in some instances, of derangement of the digestive organs; and in others, of weakness occasioned by continued grief, mental anxiety, or other causes. Some alleviation in this most distressing affection is sometimes experienced from the use of warm and opiate fomentations; from anodyne applications, composed of preparations of conium, opium, belladonna, or aconite; or of combinations of these remedies, in the forms of liniment, ointment, or plaster. But, however necessary may be the employment of some local remedies as palliatives, the principal part of the treatment, and that on which alone dependence can be placed for effecting a cure, is the constitutional treatment, comprehending the use of such remedies as are calculated to promote the proper condition of the uterine and intestinal secretions, and to improve the general health and strength. A complete change of scene, air, and mental occupation has often been found to remove the complaint. The practitioner, remembering what are the indications to be fulfilled, will select for their accomplishment the means most suitable in the particular circumstances of each case.

MAMMARY GLANDULAR TUMOUR.

Synonyms.—This affection is called by Sir A. Cooper the chronic mammary tumour; by Mr. Abernethy the pancreatic tumour; by Cruveilhier the fibrous tumour of the breast; by Professor Paget the mammary glandular tumour; by some writers, simple sarcoma; and by others, simple tumour.

These tumours are most common in young women who are unmarried, or who have had no children: they are very seldom found to begin after the age of thirty years. Their origin is believed to be connected with deficiency or irregularity of the menstrual discharge; and a remarkable fact in regard to them is, that they occasionally disappear; and, according to a greatly respected authority, they are more likely to do so, if any imperfection of the uterine or ovarian functions, in which they seem to have their origin, be repaired by marriage, pregnancy, or lactation. The tumour is exceedingly moveable, and though furnished with a cyst, is diffused into the surrounding tissue to a considerable extent. Its form is usually oval, its surface lobulated, it has no elastic or firm feeling; its seat may be upon, within, or, in some rare instances, underneath the gland; it is most usually found near the upper margin of the gland, slightly embedded beneath its surface. In most instances, there is no accompanying pain; in some, there is uneasiness not amounting to pain; and in others, very great pain. These tumours are sometimes very rapid, but more frequently slow in their growth; sometimes their growth appears to be arrested so that they become stationary; and in a few instances, as has been already mentioned, they have been known entirely to disappear. They are formed of hypertrophy or alteration of the natural elements, and by the aid of the microscope these elements in a more or less modified form may be recognised. By the kindness of Professor Bennett I am allowed the use of the annexed woodcuts. These

Fig. 286.

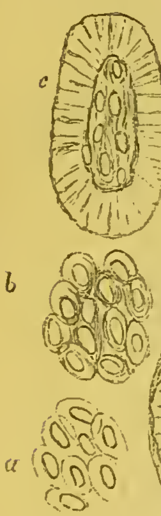


Fig. 287.

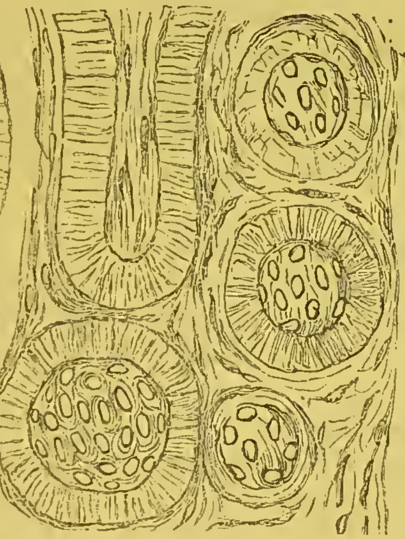
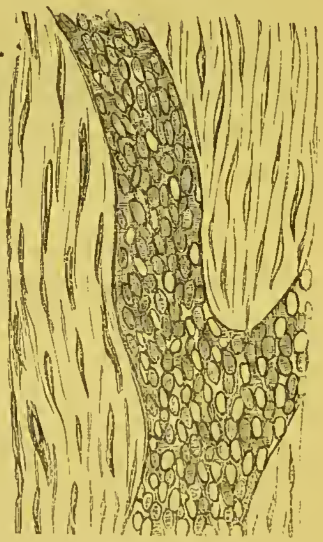


Fig. 288.



This series of diagrams represents microscopic sections of a simple tumour removed by operation from the female breast; consisting mainly of hypertrophy of the fibrous structure of the gland, with enlargement of the included ducts and their epithelial linings. *c.* Section of the epithelium from one of the tubes. *b.* Group of epithelial cells from the same. *a.* The same after the addition of acetic acid.—Bennett.

tumours are innocent in their nature, and very rarely attain to any great size; but as they may grow larger and give rise to anxiety in the mind of the patient, they should be removed by excision, which can be done with great ease and with the certainty of a satisfactory result, as they are not of a malignant character.

SERO-CYSTIC TUMOUR.

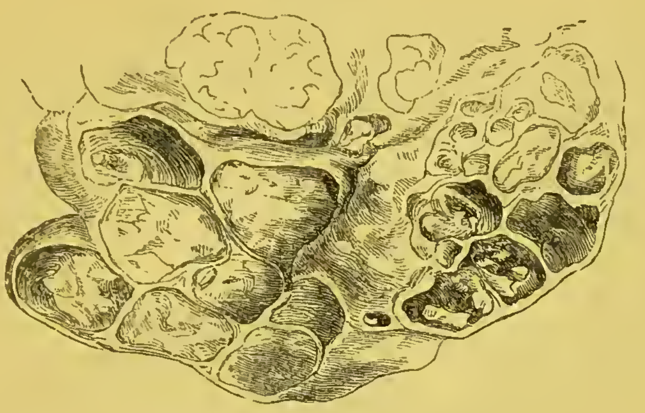
The following are three different modes of the formation of cysts:—1. Some cysts are formed by dilatation and growth of the lactiferous tubes. A cyst formed in this way may be emptied through the nipple, and as was pointed out by Sir Benjamin Brodie, a bristle may in some cases be sent through one of the ducts into the cyst. The cyst is slow in its growth, rarely attains very large dimensions, and in the majority of cases is unattended with pain; but in some, patients experience a darting pain, or stinging, especially on manipulation, and about the menstrual period. In most cases, however, the disease gives rise to no inconvenience, except the anxiety caused by the presence of any kind of tumour in the breast. The health is not impaired. The skin retains its natural colour. The axillary glands do not become affected: and on manipulation at an advanced period, fluctuation reveals the existence of a fluid, but at an early stage, the tumour has rather a solid feeling. The cyst has a covering of fibro-cellular tissue, is lined with epithelium, and may contain milk, or a fluid containing epithelial scales, or fatty matter, but most commonly serous fluid, which sometimes exudes from the nipple. The fluid may be clear, green, reddish, or variously tinged. It is extremely unusual for this disease to begin after the fiftieth year.

2. Another mode of formation of cysts is by enlargement and fusion of spaces of the fibro-cellular tissue. Effusion takes place into the spaces, and the fibro-cellular tissue becomes expanded and condensed into a cyst.

3. It is probable that, in many instances, cysts in the mammary gland are formed by the enormous growth of new formed elementary structures, having the character of cells or nuclei, which pursue a morbid course from their origin, or from a very early period of their development.

These three modes of the formation of cysts have been briefly described, as formation by dilatation and growth of parts of ducts, by enlargement of natural spaces, and by development or growth of new formed nuclei or cells. Those cysts, the contents of which are liquid, are called barren; and those which have the power of forming more highly organized contents are called proliferous. The contents of proliferous cysts vary very much in different parts of the body, but in the breast they consist of glandular or other vascular growths, which spring from their walls, constituting with their cysts the cysto-sarcomata of Brodie. These intra-cystic mammary growths increase more rapidly than their cysts, and at length, excluding the fluid, fill the cysts; in many cases, they coalesce entirely with the cyst walls, and in others, projecting through them and growing rapidly, they advance to the integument; and sometimes even make their way through it. These growths also exhibit great varieties with regard to colour, vascularity, and density. They are found in women of all ages, from the period of puberty to the cessation of menstruation; and although they may co-exist with cancerous growths, they are perfectly free from anything of a malignant character. In the case of a single cyst, a successful result has been obtained by making an incision for the escape of the fluid, or evacuating it by means of a small trocar, and afterwards employing the ordinary means for promoting the obliteration of the cyst by adhesion or granulation: but excision of the whole of the diseased part is the only certain means of cure; and when there are more cysts than one, the proper proceeding is ablation of the breast, and as the disease is not malignant, there is every prospect of a satisfactory result, if the whole be removed.

Fig. 289.



From DRUITT.

TRUE HYDATID CYSTS IN THE MAMMA.

This is an extremely rare form of breast-disease, and consists of a parent cyst, containing living entozoa. Within the parent cyst are secondary cysts, which consist of parasitic animalcules, named echinococcus hominis, floating in a limpid fluid. This form of disease is met with between the ages of twenty-one and fifty years, chiefly in married women who have enjoyed good health, to which the development of the tumour has not been observed to cause any interruption. The tumour is for the most part globular or oval in form; varies in size from an inch to several inches in diameter; and has been found in different parts of the gland. The tumour becomes prominent at its middle, is hard at first and incompressible, but by and by becomes lobulated with obscure fluctuation, and ultimately fluctuation becomes uncommonly distinct. In some cases there is no pain; in some there is uneasiness; but in others the pain is very great.

Excision is the proper treatment, and if the cyst be removed, a perfect cure is the result.

Besides the tumours mentioned in this chapter, the mamma is also liable to become the seat of fatty, fibrous, fibro-serous, cartilaginous, or carcinomatous tumours. For information on these tumours, the reader is referred to the chapter on Tumours, in which their characters, progress, and treatment have been described.

EXCISION OF THE MAMMA.

The patient having been placed in the recumbent posture, with the arm raised, extended, and committed to an assistant to maintain it in that position, the surgeon introduces the knife on the axillary aspect of the mamma, on a line with the mammilla, and directs it quickly and boldly to the opposite point, forming a semi-elliptical incision along the lower aspect of the tumour; the lower incision being first made, that its course may not be obscured by blood. A semi-elliptical incision is then made along the upper aspect between the same points of entrance and exit. The knife being next carried in a sloping direction, the dissection is conducted boldly and promptly from the axillary aspect of the wound, in order that, by the early division of the principal trunks, hemorrhage may in the subsequent parts of the dissection be as much as possible prevented. The extent of parts to be removed must vary, to a certain degree, according to the laxity of the integument, but chiefly according to the size and nature of the tumour, it being necessary, as has been already stated, to remove a considerable portion of apparently sound tissue, if there be reason to fear that the tumour is not of an innocent character. Hemorrhage having been arrested, the edges are brought together, and the parts treated according to the approved principles for such wounds.

CHAPTER XXVIII.

AFFECTIONS OF INTEGUMENT AND NAILS.

ANTHRAX.

Anthrax or carbuncle is a swelling of the skin, varying in size from that of a nut to nearly that of the closed fist, and caused by infiltration of an unhealthy lymph. The swelling is at first very hard, and of a dusky-red colour. This colour, in the progress of the case, may be observed to become of a deeper tint at certain points, which, on palpation, are found to present more or less of a feeling of fluctuation. At these darker points, also, the swelling becomes gradually softer and more prominent, and at length the skin ulcerates, and gives exit to an unhealthy sanious pus, soft fibrinous exudation, and sloughs of the areolar tissue. After these matters have been all discharged, the wound heals by a process of granulation, which, in cases of carbuncle, usually proceeds very slowly. The complaint is usually accompanied by more or less of fever, which, in some cases is severe, speedily assuming a typhoid form; and also in all cases by a considerable prostration of strength. The disease generally attacks persons in a weak state of health, and often prevails, as it were epidemically, at times when erysipelas and other adynamic forms of fever are prevalent.

The treatment of carbuncle may be divided into the constitutional and the local.

The great indications of general or constitutional treatment are, to promote a healthy performance of the various secretions; to allay pain and procure rest by opiates, such as the liquor ammoniæ acetatis, and morphia; and to administer as soon as possible, bark, wine, brandy, and beef-tea, or other nourishing form of food, as the circumstances of each particular case may require.

The objects to be fulfilled by local treatment are two—to promote suppuration, and to facilitate the discharge of sloughs. For the first end, we apply poultices or warm fomentations; and for the second, it is the general rule to make a crucial incision into the swelling, and afterwards, to apply poultices to expedite the separation and discharge of sloughs. The process of granulation, as already observed, is usually very tardy, and calls for the use of resinous, or some other stimulating ointment.

ONYCHIA.

By onychia is understood a swelling, usually terminating in suppuration, which arises at the roots of the nails of the fingers or toes; and it is usually divided into two varieties—the simple and the specific.

Simple onychia is usually caused by some violence, such as the impaction of splinters of wood or any other foreign body below the nail, and is characterized by there appearing at one side of the nail a circumscribed, red, swollen, and tender spot, which gradually terminates in the formation and discharge of pus, together with loosening and casting off of the old nail.

In this form there is usually not much constitutional disturbance; and the complaint terminates satisfactorily after a free purge, elevation of the foot, if the toe is the seat of the affection, local antiphlogistics, poulticing, and in many cases the judicious removal of the old nail after the process of its detachment is commenced.

Malignant onychia is of an essentially unhealthy character, and is of frequent occurrence in a syphilitic condition of the system. In this variety the inflamed part is of a very dusky red or livid hue, and very speedily becomes the site of an ulcer, which discharges a very fœtid and usually more or less sanious pus. In the course of a short time, large flabby granulations form at the roots and sides of the old nail, which gradually assumes a dried, brownish-black appearance, and falls off in laminæ or layers.

For the relief of this complaint both constitutional and local treatment are necessary. The object of constitutional treatment is, to improve the general health, and, as is often necessary in cases of malignant onychia, to remove a constitutional cachexia. For this end some recommend calomel and opium, others the bichloride of mercury and sarsaparilla; but a gentle course of some preparation of mercury is usually necessary to ensure a cure. The local treatment comprises removal of the nail, touching the flabby granulations with nitrate of silver, and subsequently employing a weak nitrate of silver, an arsenical, or the black wash.

INGROWING OF THE NAIL.

Persons who confine their feet in tightly-made boots, frequently suffer from an ingrowing of the nail of the great toe. As the soft parts on each side are, from confinement, kept constantly pressed against the sharp edges of the nail, the result is, that the nail penetrates the skin, a crop of flabby granulations springs up, from which a certain amount of fœtid pus is discharged, and the party affected speedily loses the comfort and use of his foot.

The proper remedy for this painful affection is, removal of the nail, and afterwards treating the ulcer according to the usual rules of practice. To remove the nail, the surgeon firmly grasps the toe with his left hand, passes one blade of a strong-pointed pair of scissors beneath the nail up to its roots, then cuts it through its entire length, and twists off first one half and then the other.

LUPUS.

Under the term lupus are comprehended two affections of the skin, named respectively, lupus non exedens, or lupiginous ulcer of the face, and lupus exedens, rodent ulcer, or noli me tangere of early writers, by all which names it is known in surgical works.

Lupus non exedens, or lupiginous ulcer of the face, is a peculiar form of ulceration, most usually occurring in strumous females, and beginning in most instances at one ala of the nose. It first shows itself either in the form of a defined glistening swelling, which soon becomes the site of an unhealthy ulcer, or as a small scab or crust, on the removal of which may be seen a slight crack or excoriation, emitting a scanty viscid discharge, which soon concretes into a firm scab after the detachment of the first crust. The ulcer has a great tendency to spread, and at times remains a comparatively superficial sore, whilst at other times it destroys the entire alæ and columna of the nose.

The disease is usually very obstinate, frequently lasting for years, and leaves a white shining cicatrix, and causes much shrinking and wrinkling of the skin, with consequent great distortion of the features. The treatment of this complaint is both local and general. Among the most commonly employed and generally useful local applications may be mentioned weak lead and opiate lotion, weak nitrate of silver lotion, black wash, yellow wash, glycerine, or simple water-dressing. The grand indication of general treatment is, to improve the strength, and, if possible, remove the constitutional cachexia which so frequently accompanies this disorder. For this end, the energetic and steady employment of cod-liver oil, and some preparation of iodine, iron, arsenic, or other tonic, is indispensable.

Lupus exedens, or, as it has been variously named, corroding ulcer, rodent ulcer, cancroide, cancerous ulcer, and noli me tangere, is a more serious and generally more rapidly progressive disease than the lupus non exedens. It usually manifests itself on the nose, and begins either in the form of a little tubercular swelling of the skin, or as a little foul ulcer on the cutaneous or muco-cutaneous surface, surrounded by a dusty red areola, and accompanied with much swelling and pain. The ulcer is generally at first concealed from view by a scab of considerable thickness, and it may remain in this condition for a greater or less time, without making any apparent progress; but when the scab becomes detached, the sore rapidly spreads over the surrounding integument, and frequently penetrates through the entire thickness of the skin, and destroys the alæ, tip, and columna of the nose. The disease is characterized by periods of repose, and of activity. After the separation of one scab, the ulcerative action usually proceeds very rapidly; but on some occasions it is, for the time, arrested, and the sore becomes covered with hard yellowish-grey crusts. In cases which have not yielded to treatment, these crusts are in turn detached, and the disease makes frightful ravages on the face, entirely eroding the nose, and in some cases where the disease occurs in a syphilitic state of system, the nasal, and oral, and sometimes even the orbital cavities are all laid open, and, in a few instances, made to communicate with one another.

The treatment of this distressing complaint resolves itself into the local and the constitutional.

As long as there is any inflammatory action, there can be little hope of arresting the progress of the disease by the application of escharotics. The first great indication of local treatment, is, therefore, to subdue all inflammation by leeches, poultices, or warm opiate lotions; and in some instances great benefit is derived from brushing the inflamed skin with a very strong solution of nitrate of silver. After all inflammation is subdued, much may be hoped from free and thorough cauterization of the diseased surface with some of the strongest escharotics, such as chloride of zinc or arsenic, the Vienna paste, or the acid nitrate of mercury. Much good may be expected from thorough cauterization; but only mischief can result in this disease from the inefficient application of escharotics. The pain resulting from their employment is often very severe, and calls for the repeated administration of solid opium. The eschars consequent on the cauterization are often very long in becoming detached; but when they do so, great attention is required to see that the surface of the sore has a healthy appearance; and if it has not, it must at once be destroyed by reapplication of the escharotic. It sometimes happens that the sore cannot be cauterized, and then we can only employ mere palliative remedies.

The great indication of general treatment is, to alter or remove the constitutional state accompanying the disease. When the patient is of a strumous habit, much good may be expected from the steady administration of good diet, cod-liver oil, iodide of iron, or iodide of potassium; and the employment of Donovan's solution of arsenic has been followed in many cases by the happiest results. Such are the most serviceable remedies in cases occurring in the strumous habit; and the complication with a syphilitic taint calls for the immediate use of medicines suitable for that state of system.

NÆVUS.

There are three distinct forms of nævus, named arterial, capillary, and venous. They include, under the various affections termed aneurism by anastomosis, mother's mark, erectile tumours, and telangeiectasis.

Arterial Nævus, or Aneurism by Anastomosis, may be situated in every tissue or organ of the body; but it is more commonly met with in the subcutaneous or submucous cellular tissue, especially about the scalp, orbit, face, lips, and tongue; it has also been met with in the trunk, nates, extremities, in the liver, in various other internal organs, and in bone. In bone it is not unfrequently associated with encephaloid disease. This disease presents itself as a tumour, or swelling, varying greatly in size and form in different cases. As seen through the skin, it is of a bluish-red colour, or dimly blue. It is soft, compressible, not in general circumscribed, disappears to a considerable degree on firm pressure. Its temperature is usually a little higher than the surrounding parts. The tumour becomes smaller on interrupting the circulation leading to it, and instantly enlarges on allowing the blood to flow to it. In these tumours pulsation and bruit are perceptible; but the characters of these symptoms vary in different cases, according to the size of the tumours. In some cases the pulse is very strong, and in others, where the tumour is small, a slight vibratory movement only may be perceptible. In no case is the pulsation so forcible as in aneurism. The bruit presents great varieties with respect to degree and character. It is sometimes soft and blowing, or cooing, and at other times, loud and harsh. The sound is perfectly different from that of common aneurism, and when once heard, can never be mistaken. The tumour consists principally of arteries tortuous and serpentine in direction, excessively elongated, and, in point of size, enormously dilated, and often assuming a varicose appearance. The arteries leading to the part are also expanded—their coats, as well as those of the arteries of the tumour, are thin, and they pulsate strongly. This condition is called cirsoid dilatation of the vessels.

Treatment.—This varies according to the size and situation of the tumour, and may be said to consist of removal or deligation of the artery furnishing the arterial supply. Removal should always be had recourse to when practicable; and of the two modes, namely, by ligature and by excision, the former should generally be preferred. The mode of applying the ligature will be afterwards described. Should excision be practised, even for a small tumour, it is of the utmost importance to cut at a very considerable distance from the disease; otherwise alarming or fatal hemorrhage may be the result. Two modes of deligation, as well as of removal, have been practised in the treatment of these tumours, namely, tying the principal branches leading to it, and ligaturing the main trunk of the part or limb; the latter, in the present state of our experience, appears to be the only proper proceeding, as the former, so far as my reading has enabled me to judge, has uniformly been unsuccessful. In two cases, however, of this disease in the scalp, Dr. Gibson succeeded by tying the principal feeding branches, and making deep incisions around the tumour between the deligated arteries. The brachial and femoral arteries have been tied in some cases, with the desired result; but the carotid has been more frequently tied than any other artery for the cure of this disease. In 6 cases in which it was tied for this disease in the orbit, 5 were cured. Of 20 cases in which it was tied, in 5 both carotids were tied at intervals of several weeks, and in all these cases of double deligation the disease was cured.

Capillary Nævus is almost always congenital; it is but very slightly elevated, it presents great varieties as to size, is of a purplish-red colour, and is unattended with pain or inconvenience beyond its unseemly appearance. It is formed of a congeries of small capillary vessels.

Venous Nævus is of a dark-purple colour, often becomes prominent and forms a large tumour, feels doughy, soft, and elastic, is compressible, is sometimes small, and at other times lobulated, and the surrounding veins are large and tortuous. It is formed of dilated tortuous veins, and, in some cases, along with these small cysts, emits a fluid, usually dark and sanguinolent, but sometimes clear. For much interesting information on the structure and characters of these vascular growths, I refer the reader to the writings of John Bell, Wardrop, Mr. Cæsar Hawkins, Mr. Goodsir, Mr. Liston, Rokitansky, Mr. Birkett, and to the valuable and most instructive lectures of Mr. Paget.

Treatment.—There are three different principles on which the principal methods of treatment have been conducted, namely, to cause obliteration of vessels by means of adhesive inflammation, destruction of the growth, and removal by ligature or knife.

1. Vaccination, passing a few silk threads through the tumour, passing acupuncture needles into it, and heating them by means of the spirit lamp, injecting a few drops of the perchloride of iron by means of a syringe with a screw piston, are some of the many modes of treatment conducted on the first-mentioned principle.

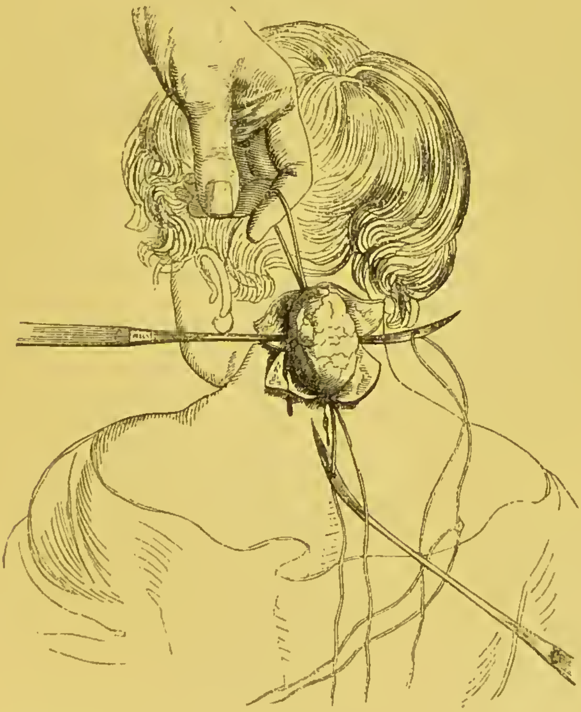
2. Destruction by repeated application of nitric acid, or some other escharotic, is a very successful mode of treatment, when the nævus is capillary and small.

3. In the great majority of cases, when the disease constitutes more or less of distinct tumours, removal by ligature is the proper, and, indeed, with few exceptions, the only proper method of removal. Subcutaneous ligature, as proposed by Mr. Curling, consisting of passing a thread subcutaneously and then tightening it, is a method that is exceedingly suitable in some cases. I have often adopted this mode of strangulation with success. When the tumour is not very large, by passing the acupuncture needles under its phase, and drawing a ligature very tightly under them and around the base of the tumour, removal

by strangulation and sloughing is speedily effected. If the tumour be large, then a double ligature may be passed by means of a needle, and strangulation effected in the same manner as for internal hæmorrhoids; and if still larger, it may be strangulated by passing two double ligatures, and strangulating it in four, instead of two parts. Mr. Liston recommended the following proceeding in some cases :—

"When the skin is slightly or not at all affected, and the subcutaneous tumour is large, the coverings should be turned back, as represented below, and the ligatures then employed. A few weeks ago, I operated for a tumour in this situation on a little girl who had been subjected to several painful and unsuccessful operations previously. One needle, that across the morbid mass, was in the first instance introduced without a ligature, after the incisions had been made; the tumour was raised by means of it, and the second needle passed underneath the first, carrying a strong thread; the loop of this was laid hold of with a hook, and the needle withdrawn upon the ligature, as here represented. The first needle was then armed also, and the double ligature brought through with it. These were then secured. This mode of proceeding is very superior to those generally followed, and is not liable to any objection. It is, besides, the only plan by which tumours of a formidable size and highly vascular, tumours generally considered incurable, can be safely dealt with. There is no risk of untoward bleeding in cutting through the skin and dissecting back the flaps from the tumour. Of course these are made so as to leave any por-

Fig. 290.



tions of the skin that may be at all affected still attached to the part to be removed. The mass is thoroughly exposed, so that the ligatures can be introduced completely under and beyond it in all directions; and these can be drawn at once so tightly as to cut off its connexion with the circulation, and destroy its sensibility and vitality. The operative procedure is necessarily varied, according to the circumstances of each particular case. The principles being understood, the details must be left to the judgment and discretion of the practitioner concerned. After the tumour has been strangulated completely, free puncture may be made into it so as to diminish its bulk. The painful feelings may be soothed by sedatives suited to the age and condition of the patient, and by warm water applied to the part, as described again and again in the foregoing pages. By following this method, the period necessary for a cure is much abridged: there is less suffering entailed on the patient, deformity is avoided, and the operation is without doubt more safe and certain than any other."

CHAPTER XXIX.

AFFECTIONS OF THE EYE AND ITS APPENDAGES.

OPHTHALMIA.

ALL inflammatory affections of the eye-ball and conjunctiva are comprehended under the general term, Ophthalmia.

INFLAMMATORY AFFECTIONS OF THE CONJUNCTIVA.

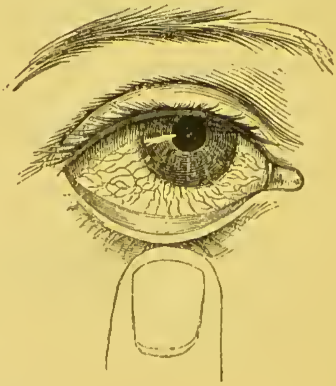
Of conjunctivitis, or inflammation of the conjunctiva, there are several varieties, of which the principal are, 1. *Simple*, 2. *Pustular*, 3. *Catarrhal*, 4. *Purulent*, and 5. *Strumous.*

I. SIMPLE CONJUNCTIVITIS.

This affection is by some authors described under the more general term, ophthalmia simplex.

Symptoms.—The principal symptoms are, pain of a sharp pricking character, a distressing sensation of heat and stiffness, a feeling as if sand or some other extraneous matter were lodged on the surface of the membrane, intolerance of light, and lachrymation; and on opening the eyelids, the conjunctiva is found to present a red appearance of a scarlet tint, with a peculiar arrangement of the vessels, which requires to be carefully noticed for distinguishing inflammation of the conjunctival covering from inflammation affecting the deeper textures of the eye. The arrangement of blood-vessels characteristic of this affection is called reticular, and is represented in the accompanying drawing. The vessels are superficial, large, and tortuous in their course from the orbital circumference of the membrane towards the margin of the cornea; they can be drawn aside or moved by dragging the eyelids with the finger, or by communicating movements to the membrane; they anastomose very freely with each other, and produce a beautiful web-like or net-work appearance. In very severe cases, the minute vessels become so much distended as to make the reticular arrangement less distinct, or altogether imperceptible; and in place of it, the membrane exhibits a

Fig. 291.



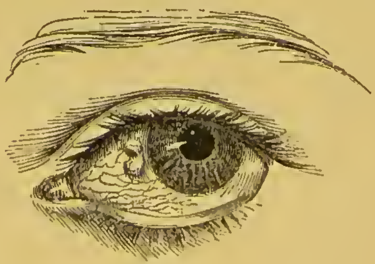
uniform florid hue, with a very irritable appearance. There is slight febrile action in severe cases, but in others there are scarcely any constitutional symptoms.

Treatment.—In the treatment of this, as of other forms of ophthalmia, it is important to keep in view some rules which are universally applicable in all inflammatory affections of this organ, namely, to remove the exciting cause if still in operation, to guard against all new causes of irritation, either to the eye itself or to the system at large, to obviate if possible the predisposing cause, which may be derangement of the functions of an organ remote from the eye, to exclude the light, and to give absolute rest, not only to the affected eye, but also to the other. In many cases of simple conjunctivitis, attention to these rules is alone sufficient to produce the desired effect; in other cases, it is requisite in addition to this to prescribe sometimes rest of body, low diet, aperient medicine, and cold applications over the eyelids, and sometimes local depletion followed by warm applications. Local depletion may be instituted either by leeches, which should be applied, not to the eyelids, but around the eye, to the temple, the forehead, or the nose,—or by scarification of the conjunctiva of the eyelids, the efficacy of which in acute cases is often very speedily perceptible. The above treatment must not be too long continued, lest relaxation be induced; nor is it suitable in those cases which from the commencement partake of a chronic character, and in which passive congestion constitutes the principal condition of parts. When acute symptoms have been subdued, counter-irritation applied to the temple or behind the ear, and the cautious use of some slightly stimulating lotion, together with constitutional remedies, constitute the proper treatment.

II. PUSTULAR CONJUNCTIVITIS.

Synonyms and *Symptoms.*—This affection—sometimes called conjunctivitis pustulosa, ophthalmia pustulosa, and ophthalmia plyctænodes—commences with pain, usually very slight, but varying in degree in different cases, and attended with an uneasy sensation as if caused by an extraneous substance, and felt principally during the movements of the palpebræ. Intolerance of light is not usually a symptom of this variety. There is often a secretion which coagulates and causes the lashes to adhere together. The palpebral division of the conjunctiva is more red than is natural; on the ocular portion there is increased vascularity at some part, and sometimes one plexus of vessels appearing, sometimes several, each having its base towards

Fig. 292.



the orbit and its apex towards the cornea. Lymph is deposited, and in the lymph pus is formed constituting a pustule, the most frequent site of which is over the junction of the cornea with the sclerotic coat. In many cases there is a deposit of lymph and serum, so that the affection presents the character of a vesicle instead of a pustule.

Pustular conjunctivitis is chiefly met with in children and young persons, and more especially in those who are of a scrofulous diathesis, and liable to derangement of the function of the skin, or of the digestive organs.

Treatment.—When the disease is very acute, in addition to rest of the eye, restriction of diet, and purgation, local depletion is necessary; but in the great majority of cases, the observance of the general rules of treatment already laid down, together with the application of some stimulating or astringent lotion, will be found sufficient. Of the many applications of this nature the solution of the nitrate of silver, of the strength of from two to four grains to an ounce of water, answers as well as can be desired.

III. CATARRHAL CONJUNCTIVITIS.

Symptoms.—In addition to the usual local symptoms of catarrh, and, in many cases, the general symptoms of catarrhal fever, though there is frequently but little constitutional disturbance, the patient is affected with stiffness and heaviness in the palpebræ, reticular redness commencing on the palpebral portion of the conjunctiva, sandy pain, as it has been called, great lachrymation, adhesion of the eyelids in the morning, and a discharge of opaque viscid mucus which collects on the cilia during sleep, with aggravation of all the symptoms in the evening. In some, though comparatively few instances, chemosis takes place to a considerable degree; and in these circumstances there is ground for anxiety as to the condition of the cornea, as it may become the subject of ulceration, or its vitality may be endangered, partly by purulent infiltration between its lamellæ in consequence of inflammation, and partly by mechanical pressure, produced by great distension of the conjunctiva impeding the circulation.

Treatment.—The constitutional treatment varies according to the state of the symptoms affecting the general system; but in all cases, the condition of the bowels and skin must be attended to, and a proper performance of the functions of those organs promoted. The chief part, however, of the treatment is local and of a stimulating nature; and under such, the disease in most cases very soon subsides. The treatment I have usually employed, and with most satisfactory results, is that recommended by M'Kenzie, namely, scarification of the conjunctival lining of the palpebræ, when the chemosis is great, and the discharge distinctly purulent; the application of a few drops of the solution of the nitrate of silver twice a day; fomenting the eyelids several times a day with a collyrium composed of one grain of corrosive sublimate, six grains of muriate of ammonia, two drachms of vinum opii, and eight ounces of water, used slightly warmed, a few drops being put into the eye in mild cases, but injected over the eye in severe cases; anointing the margins of the eyelids every night at bedtime with a very small portion of an ointment composed of six grains of the red precipitate levigated to an impalpable powder and half an ounce of butter, for preventing the tendency to adhesion of the eyelids; keeping the patient in a dark room, avoiding all cold applications, and in the chronic stage, when very obstinate, using slight counter-irritation. This last is, however, required in comparatively few cases, as the symptoms generally yield very readily to the use of the other remedies.

IV. PURULENT OPHTHALMIA.

Ophthalmia purulenta is the name given to a violent form of inflammation of the conjunctiva attended with a secretion of pus. It will enable us to describe more clearly this very distressing affection, if we treat separately of three different forms of it, namely, purulent ophthalmia in adults, purulent ophthalmia in newborn infants, gonorrhœal ophthalmia.

Purulent Ophthalmia in Adults.—Symptoms.—One of the earliest symptoms is an itching sensation, owing, it is believed, to suppression of the mucous secretion—a symptom which is well known to be one of the earliest effects of inflammation in a mucous membrane. Another early symptom is a painful feeling as if particles of sand or glass were lodged between the eyelids and the eyeball. This feeling, which is often very severe, comes on very suddenly, and arises not from the presence of any extraneous matter, but from the dilated state of the conjunctival vessels.

There is at an early stage considerable mucous secretion from the internal surface of each eyelid. This soon becomes opaque, and then, very rapidly, purulent; and when the eyelids are separated, it runs down the cheek, producing in many instances irritation and excoriation. In this variety of the disease there soon occurs very acute and continued pain, attended with a most distressing sense of fulness and tension; there is also a sense of weight and stiffness, with great swelling of the palpebræ; and the cilia adhere to each other, in consequence of the coagulation of viscid mucus upon them. The palpebral portion of the conjunctiva is first affected; it becomes exceedingly red and swollen; great effusion takes place into its substance, as well as into the submucous cellular tissue and the other textures of the palpebræ, so that they rapidly become very much swollen and of a livid appearance, and are apt to become everted. The eyelids have at first a slight tendency to become inverted, but the great swelling and protrusion of the conjunctiva, which is forced out between the eyeball and the margin of the palpebræ, soon produce a tendency to eversion. At an advanced stage of the disease, the conjunctival covering of the palpebræ often assumes a kind of granular appearance, arising from the enlargement of the natural papillæ. The ocular portion of the conjunctiva becomes exceedingly red and swollen, effusion taking place to a great extent into its substance, and also underneath it into the submucous cellular tissue, raising the conjunctiva considerably around the circumference of the cornea, and constituting the condition technically called *Chemosis.* The cornea becomes hazy, and afterwards opaque and dull in appearance; and if the symptoms are not subdued, the haziness greatly increases, and the cornea soon loses its vitality, and is wholly or partially destroyed, in consequence of its nutritious fluid being interrupted by the tension of the conjunctiva and the rapid deposit into the submucous cellular tissue. The patient suffers much from circumorbital pain, as well as from the pain and other symptoms already mentioned as affecting the eyeball and eyelids. The constitutional symptoms are at first those of inflammatory and afterwards those of irritative fever; and their intensity is proportionate to the severity of the local disease.

Causes.—There is little doubt that in some cases, even in this country, this very serious disease originates in atmospheric influence; but fortunately it is of comparatively rare occurrence, and of the cases that do occur, a small number only are produced by this cause. It is well known, however, that in other parts of the world, as in Egypt, a very alarming form of this disease prevails at different periods, owing its origin to atmospheric influence. When the disease once takes place, it is very apt to be propagated by contagion; and there is reason to believe that in confined and crowded houses, in certain situations, the disease may also be conveyed from one person to another, without the actual contact of matter with the eye, but by infection. In this country the majority of cases of purulent ophthalmia in the adult are produced by the contact of matter from the urethra, vagina, or an eye affected with the disease.

Treatment.—The treatment of this highly dangerous disease must be exceedingly prompt, and proportioned in degree to the age and strength of the patient and the intensity of the disease. The constitutional treatment in the early stage consists in venesection, low diet, perfect rest, purgative medicines—sulphate of magnesia with tartar emetic being found exceedingly useful—together with calomel and opium until the system be slightly affected. The patient should be kept in a cool, dark, and well-ventilated apartment. The local treatment most useful in the early stage consists in local depletion by means of leeches applied around the orbit, but not to the eyelids; by scarification of the palpebral portion, and also by horizontal incisions in the ocular portion of the conjunctiva, the eyelids being kept separate to promote the depletion; diligent fomentation of the eyelids; great attention to cleanliness, and the frequent and effectual cleaning of the eyes. For this purpose a fluid must be sent between the eyelids and eyeball, by means of a small syringe, so as completely to clear away the matter, which collects very rapidly. A mild astringent should also be used two or three times a-day: one of the most valuable remedies of this class is, the solution of the nitrate of silver in the proportion of three or four grains of the nitrate to an ounce of water, which generally has in a short time a decided effect in diminishing the discharge. In the more chronic stage of the disease, counter-irritation is very serviceable; and more powerful astringents are often required, such as a strong nitrate of silver ointment, or the solid nitrate of silver, applied with a pencil to the inside of the eyelids; or when the discharge has ceased, and the object is to apply an astringent to the relaxed conjunctiva, a few drops of the vinum opii are used with advantage.

Purulent Ophthalmia in newborn infants.—Causes.—Ophthalmia neo-natorum, or the purulent ophthalmia of infants, is in the great majority of cases caused by the contact of leucorrhœal, or in some instances of gonorrhœal, secretion with the conjunctiva, during the passage of the infant through the vagina, and want of attention to the careful washing of the infant's eyes immediately after parturition. Sometimes, however, the disease is catarrhal, arising from the injudicious exposure of the child to cold air; or it may be caused by the soap with which the child is washed entering the eyes; or by the exposure of the eyes to a bright light.

Symptoms.—This disease usually begins to show itself on the third day after birth, at which time the ciliary margins of the palpebræ are observed to be of a pinkish red colour and glued together by a concrete puriform secretion; and if they be gently separated from each other, a little white matter escapes, and the conjunctival covering of the eyelids is extremely red, vascular, and swollen. The palpebral portion of the conjunctiva is first affected, the ocular portion soon becomes involved, effusion takes place into the subjacent cellular tissue, and chemosis is produced; the palpebræ become much swollen, tense, and of a livid red appearance; and the palpebral conjunctiva exceedingly tumefied, so that when the eyelids are separated, it is apt to project and cause eversion of the eyelids; the discharge becomes very great and of a yellow colour; if the disease be not checked, there is great danger of the cornea being either partially or totally destroyed, particularly when the chemosis is considerable, as this produces obstruction of circulation; purulent matter is infiltrated between the lamellæ of the cornea; and the lamellæ exterior to the pus giving way, the destruction spreads by ulceration.

Treatment.—The treatment I have always adopted in this form of ophthalmia is that recommended by Mr. M'Kenzie, namely, washing the eyes three or four times in the twenty-four hours with a tepid solution of one grain of corrosive sublimate with six of sal ammoniac in eight ounces of water; applying once or twice a day a few drops of a solution of the nitrate of silver in the proportion of four grains to an ounce of water; applying also to the edges of the eyelids at night, in order to prevent their adhesion, a small portion of the red precipitate ointment, prepared, as recommended by Mr. M'Kenzie, by mixing six grains of the red precipitate carefully levigated into an impalpable powder with half an ounce of butter, the ointment being melted before being applied; a small dose of calomel daily, from a quarter to half a grain; occasional doses of castor oil, and slight counter-irritation behind the ears.

Gonorrhœal Ophthalmia.—There are no symptoms by which it is possible with absolute certainty to distinguish gonorrhœal ophthalmia from purulent ophthalmia produced by atmospheric influence and other causes. The history of the case will afford ground for diagnosis; and if there be very profuse discharge, if the eyelids be exceedingly swollen and livid, with much pain, and if one eye be severely affected and the other remain uninjured, there will be reason to conclude that the disease is gonorrhœal ophthalmia. In the other forms of purulent ophthalmia, it is the rarest thing possible for one eye only to be affected, and in them the palpebral portion of the conjunctiva is the first attacked; but in this form, the ocular portion is first affected, the disease extending itself very rapidly to the palpebral division, and it is seldom that both the eyes are involved. This disease is extremely rapid in its progress; the danger of loss of vision from destruction of the cornea is very great; and the symptoms must be promptly combated by the treatment already recommended for purulent ophthalmia in the adult.

V. STRUMOUS CONJUNCTIVITIS.

Symptoms.—This affection is indicated by the symptoms of the ordinary varieties of conjunctivitis accompanied with the following peculiarities, namely, that the lachrymation is great, and the intolerance of light or photophobia quite disproportioned to the local signs of inflammation.

" From the intolerance of light the patient subject to this disease avoids the light as much as possible; and children usually lie upon the stomach and bury the face in the pillow, or endeavour to exclude the light more effectually by the aid of the handkerchief or the hands, which they press closely on the affected organs. When exposed to the light for the purpose of examination, the head is immediately shrunk upon the chest; but if the hands be withdrawn, the palpebræ are found closely compressed together, and they are corrugated by violent, and sometimes spasmodic action of the orbicular muscles. It is not unusual, further, to find the face distorted by the action of the other superficial muscles of this region, not connected with the eye.

If the disease has been of long standing, the surfaces of the eyelids and of the cheeks are frequently red and excoriated from the irritation of scalding secretion and pressure of the hands of the patient."

The ocular and palpebral portions of the conjunctiva present numerous distended vessels, and the appearances usual to the common varieties of conjunctivitis; but at the same time the local appearances bear no proportion to the excessive morbid sensibility of the eye to the light. The inflammation is very apt to give rise to pustules on the circumference of the cornea or near it, and also to ulceration of the cornea.

Treatment.—This affection is always attended with derangement of some important function, most frequently of that of the skin or the digestive organs; and a principal part of the treatment consists in the employment of judicious means for promoting the proper performance of the functions generally, as well as the use of such as in the particular circumstances of the case may be suitable for scrofulous cachexy. Quinine is an invaluable remedy in this disease. The local treatment which has been found most useful is, slight counter-irritation behind the ear, preceded, if the action of the disease be very acute, by slight local depletion by leeches or scarification at a very early period; the application of belladonna to the temple every night; putting a few drops of a weak solution of nitrate of silver into the eyes once or twice a day; keeping the patient in a dark room, and preventing him from keeping up the heat and irritation of the eyes by pressing them with the hand, or by lying on the face; and paying great attention to cleaning the eyes.

SCROFULOUS CORNEITIS.

Symptoms.—It is principally found in persons of scrofulous diathesis, from eight to eighteen years of age, and is marked by the following symptoms:—a haziness, and in many cases an opacity of the cornea; roughness, with more or less of a thickened and changed state of its epidermis; redness on the surface of the cornea, presenting several varieties as to appearance, but in some instances so extensive as to have been compared to red cloth, and to have received the name of *pannus;* slight sclerotic redness of a dull character, constituted by the dilatation of small vessels, and having no white ring, such as exists between the zonular redness and the circumference of the cornea in the inflammations of the deeper tissues of the eye. In cases of considerable standing, the cornea becomes unusually convex and sometimes even conical, with *hydropthalmia,* or a superabundance of aqueous humour. There is considerable lachrymation, especially on exposure of the eye to light. The globe of the eye is somewhat tender, and there is a slight degree of dull pain; these two symptoms are usually of an intermittent character, and in some instances they are severe and distressingly aggravated at night; in the great majority of cases, however, there is little or no pain, except at the commencement of the affection. Another peculiarity distinguishing this disease from scrofulous conjunctivitis is, that, whereas in the latter the intolerance of light is so excessive as to have been called photophobia, in this disease it is not usually very great, though in some instances, especially where there is much redness, considerable pain is felt. Patients have in many instances a sensation as if a foreign substance were placed on the conjunctiva. When the disease is severe, the vision is greatly obscured, so that sometimes objects cannot be perceived, and the patient is only able to distinguish light from darkness; when it is of a milder character, there is but slight dimness, and objects are seen as through a very thin mist. The disease is slow in its progress, and is usually very obstinate; it is generally attended with other symptoms of scrofula and weakness of constitution, and with functional derangement of the skin or of some other part of the system.

Parts chiefly affected.—The superficial parts, the epidermic covering of the cornea, and the parts immediately below it, are chiefly involved, and opacity results from effusion of lymph; but pustules in the first instance, and afterwards ulcers, are often formed, and although the disease is generally seated in the superficial parts, it may affect the whole substance of the cornea, and extend to the iris, the sclerotic and choroid coats, and even to the retina itself.

Treatment.—In this, as in every other form of scrofulous inflammation, the constitutional treatment is of the greatest possible importance, the principal points aimed at being to correct the functional derangement, to improve the general health, and to arrest the deposit of fibrin, by which the opacity is produced. These important indications the surgeon must endeavour to fulfil by such means as may be judicious and efficient in the particular circumstances of each individual case; but as a general rule, the most valuable means are, good diet, pure air, quinine, and the careful use of mercury, carried only so far as very slightly to affect the system. That the two medicines, carefully and judiciously employed, are invaluable in the treatment of this disease, will be readily acknowledged by all who have tried them. The local treatment consists in depletion by leeches, when the symptoms are acute; slight counter-irritation behind the ear, or on the back of the neck; warm, and especially opiate fomentations; smearing the parts round the eye with the extract of belladonna at bed-time; and when the symptoms have become chronic, the daily application to the eye of a stimulant, such as the vinum opii. The vinum opii and red precipitate ointment are the most useful stimulants, but the former is in most instances much to be preferred. Local treatment, however, will be of little avail without the constitutional treatment proper for the scrofulous diathesis.

ACUTE CORNEITIS.

Causes.—This disease sometimes comes on without any obvious cause; sometimes it arises from direct injury, or from exposure to damp and cold; and sometimes it is a consequence of inflammation of other textures of the eye.

Symptoms.—The principal symptoms are, haziness, or cloudiness, or opacity of the cornea; lachrymation; intolerance of light; pain and tenderness in the eye; liability to exacerbations, especially at night; pain throughout the orbit; redness of the cornea, evidently owing to an innumerable quantity of vessels. When the inflammation is not confined to the substance of the cornea, but affects also its conjunctival covering, a red zone may be seen, called by some the inner zone, placed over the circumference of the cornea, and obviously formed of a number of dilated vessels proceeding from the conjunctival covering of the cornea, and penetrating the substance of the cornea itself. There is in some cases another red zone, called by some the outer zone, of a crescent shape, corresponding to a part of the circumference of the cornea, having one aspect well defined, namely, that towards the sclerotic coat, but the other not distinct, in consequence of its being lost in the inner zone. This outer zone is constituted by the vessels of the conjunctiva covering the part of the sclerotic coat where it overlaps the circumference of the cornea, as well as by some of the vessels within the substance of this portion of the sclerotic coat. A point of great importance for diagnosis is to remember, that there is no intervening white ring between this red appearance and the circumference of the cornea, as there is in inflammation of some of the deeper textures of the eye.

Treatment.—The principal remedies are, mercury, antimonials, and other antiphlogistic measures, which ought to be promptly resorted to, and continued with energy proportioned to the urgency of the symptoms and the other circumstances of the case; local depletion; warm and opiate fomentations; and, when the affection has become chronic, counter-irritation, and the very careful application of stimulants. The treatment of some of the results of the acute corneitis will afterwards be mentioned.

OPACITIES OF THE CORNEA.

Opacities of the cornea differ from each other in the degree of density and opacity, in the situation, and in the mode of formation; and the terms, nebula, albugo, and leucoma are used to distinguish the different varieties from each other.

Nebula is the term used to denote the least degree of opacity, and includes only those cases in which the cornea is cloudy or hazy. Its symptoms are a cloudy appearance and an impaired state of vision. The opacity is insensibly lost in the surrounding portions, and its edges are consequently undefined. The term nebula is by some authors made to comprehend slight opacity of the cornea from deposition between the laminæ of the cornea, or from deposition between it and its lining membrane, or between it and its conjunctival covering, as well as from changes in the conjunctival covering itself. It is here used in the sense in which it is employed by many, to denote the least degree of opacity depending on slight interstitial change in the conjunctival covering itself, or on very slight deposit between it and the cornea. This condition may result from slight inflammation, either originating in the part, or spreading to it from other textures; and the inflammation may be excited by any of the usual causes of ophthalmia; or it may be brought on and kept up by a granular condition of the palpebral portion of conjunctiva, or by inverted palpebræ, or by inverted eyelashes. These last-mentioned conditions are frequent causes of nebulæ; and the state of these parts should therefore be carefully observed, because if any such exciting causes be allowed to remain, no treatment will avail to remove the opacity.

Albugo is the name given to opacity of the cornea when it depends upon the effusion of lymph into any part of the cornea, or between it and its conjunctival covering, or when the effusion is so dense as to give it a white pearly appearance. The opacity is greatest at the centre. Inflammation of the cornea in any of its most common forms is apt to lead to albugo; but phlyctænular pustule, and onyx, or abscess of the cornea, are very common sources of this affection, of which partial or complete obstruction of proper vision and a pearly white opacity are symptoms.

Leucoma is the name given to a third variety of opacity, which depends on an opaque dense cicatrix. If the continuity of a portion of the surface of the cornea be interrupted by ulceration, sloughing, or by a wound of considerable breadth, leucoma is constituted by the corneal cicatrix by which the part is healed. Leucoma is usually depressed in the centre, and presents a contracted and circumscribed appearance. By these peculiarities it is distinguished from albugo, and by its pearly white colour from nebula. When the leucoma is large and in the centre of the cornea, loss of vision is the result.

Treatment.—The treatment of nebula and albugo is precisely the same, and consists in the removal of any exciting causes of inflammation, the subduing of the inflammatory action by the treatment formerly described, and when this has been effected, in the use of stimulants for the purpose of promoting absorption. The applications chiefly employed for this end are, the solution of the nitrate of silver, the red precipitate ointment, the vinum opii, and a solution of corrosive sublimate in the proportion of a grain to an ounce of water. It is important to select the proper time for commencing the use of these stimulants, which is not until the inflammatory action has been subdued, but soon after, because up to a certain period there is a tendency to a partial absorption of the deposits, which tendency seems to wear off in course of time.

There is much less prospect of benefit from treatment in albugo than in nebula; and in leucoma, properly so called, when of some standing, none whatever. But when opacity of the nature of nebula or albugo exists around a recent leucoma; that is, when slight deposit of lymph constituting nebula, or more dense and white deposit constituting albugo, surrounds the corneal cicatrix which forms the leucoma, the nebulous or albugineous opacity may improve under treatment, while the leucoma remains unchanged.

ULCERS OF THE CORNEA.

Corneitis, however induced, whether by inflammation originating in the cornea from any of the ordinary causes of corneitis, or from a foreign substance imbedded in the cornea, or by inflammation spreading from the conjunctiva or some other tissue of the eye, may give rise to ulcers of the cornea. These ulcers are divided into two grand classes, the one comprising those which at their commencement are comparatively superficial, and the other, those which extending deeper penetrate the whole thickness of the cornea. The difference between the two classes arises from the mode in which the ulcers originate, and the form of the inflammation from which they result. Ulcers belonging to the first class, namely, those which do not penetrate the whole thickness of the cornea, may, like ulcers in other parts of the body, exist in different states.

First, They may be in the state of *a simple healthy ulcer*. *Second*, Of *an inflamed ulcer*. *Third*, Of *an irritable ulcer*. *Fourth*, Of an *indolent ulcer*. *Fifth*, Of a *sloughing ulcer*.

Treatment.—If the ulcer belong to the first of these varieties, that is, if it be a simple healthy ulcer, all that is necessary is, to take precautionary measures that the healing process be not interrupted: these consist principally in the regulation of the bowels and diet, and the protection of the eye from exposure to light or to any other irritating influence. If the ulcer belong to the second, third, or fourth variety, the indication is to convert it into a simple healthy ulcer; and the means usually employed for this purpose are,—if it be an inflamed ulcer, to subdue the inflammation by the local and general treatment proper for the ophthalmia of which the ulcer is a result;—if it be an irritable ulcer, to touch it every second, third, or fourth day, or as soon as the pain returns, with a solution of the nitrate of silver, which diminishes the pain in a most remarkable manner; partly perhaps by forming a slight film on the surface, and partly by destroying the sensitive filaments of the nerves of the part;—and if it be an indolent ulcer, to employ some of the stimulating local applications in common use, together with suitable constitutional treatment. In the case of a sloughing ulcer, the grand indication is to subdue the ophthalmia by which the ulcer is produced; and indeed this must in all cases be attended to, otherwise little benefit will accrue from any treatment instituted for the healing of the ulcer. If the ulcer be of some standing, counter-irritation is generally very useful; suitable treatment must be employed for the condition of the general system attending the ophthalmia which gives rise to the ulcer; the eyes must be kept at rest and protected from exposure to light or to any other source of irritation; and belladonna should be applied to the temple and around the eye at night, more especially if the ulcer be deep, as a means of diminishing the risk of protrusion of the iris, should penetration of the cornea take place. In every instance, healing should be attempted as speedily as possible, lest the ulcer should become one of the second class, which comprehends all cases where penetration takes place through the entire thickness of the cornea. When an ulcer belongs to this class, the following are some of the inconveniences and dangers which result.

HERNIA CORNEÆ.

Hernia corneæ is constituted by the protrusion of the membrane of the aqueous humour, with or without some slight deposit of lymph; and when the perforation is not perfectly complete, a very thin lamella of the cornea is also protruded. The protruded portion presents the appearance of a small transparent vesicle, and the proper proceeding in such circumstances is to cut off the small vesicle by a single cut of a pair of scissors, to touch the part with a finely pointed bit of the nitrate of silver, to preserve the pupil dilated by the application of belladonna as a means of diminishing the risk of protrusion of the iris, and to endeavour by all judicious means to heal the ulcer.

PROLAPSE OF THE IRIS.

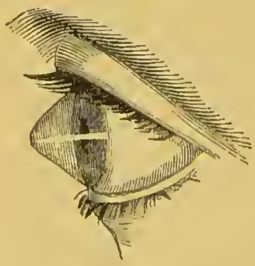
Another and a common result, when penetration extends through the entire thickness of the cornea, is prolapsus iridis, of which there are several varieties. When the protruded portion is small, it presents the appearance of a small black body, which from its supposed resemblance to the head of a fly, is termed *myocephalon*, from μυια, *musca*, and κεφαλη, *caput*; when it is larger and flatter, it is called *clavus*, from its resemblance to the head of a nail; and when the iris protrudes through many different openings, the condition is called *staphyloma racemosum*; the former term being derived from σταφυλη, *a grape*, and applied to various grape-like swellings on the front of the eye, and the latter from *racemus*, a *bunch* or *cluster*.

Treatment.—When the opening is very small and the protrusion to a very slight degree, replacement may be accomplished, if it be attempted very shortly after its occurrence, and before adhesions have taken place. It is useless, however, to employ a probe; for, although the return should be effected, the withdrawal of the probe would certainly be followed by reprotrusion. The proper mode is, to excite dilatation of the pupil by the very free application of belladonna to the temple and around the eye; and by this means the two desirable indications, namely, to effect replacement and to prevent reprotrusion, are sometimes fulfilled. All judicious means should then be adopted for avoiding irritation, and for promoting the healing of the ulcer. When the opening is larger and the protrusion to a greater degree, or of some standing, it may be impossible, in consequence of adhesions, to effect replacement; but if it were possible, it would not be desirable, for the only means of preventing escape of the aqueous humour and consequent collapse of the eye, is by allowing the iris to remain in the wound and becoming adherent. The proper steps to be taken therefore are, to promote adhesion, to avoid irritation of the eye by exposure to light, or by friction of the eyelid on the protruded part, to apply belladonna to the temple and around the eye at night, to use the treatment suitable for any accompanying ophthalmia that may still remain, and when adhesions have taken place and cicatrization advanced, to destroy the protruded part by the slightest possible touch with a very pointed portion of the solid nitrate of silver. The local application employed in the first instance for diminishing the irritability of the ulcer and promoting adhesion, is the solution of the nitrate of silver, of the strength at first of two or three grains to the ounce, and afterwards gradually stronger, if necessary. The use of the solid nitrate of silver would be attended with considerable risk of increasing the size of the ulcer, and, therefore, the solution is preferred; but after cicatrization has taken place, it may be employed in the solid form with the view and with the precaution above mentioned.

CONICAL CORNEA.

Symptoms.—The cornea presents the appearance of a cone, and generally, but not invariably, the entire cornea is affected; the apex of the cone being usually at the centre, and its base at the circumference, corresponding to the junction of the cornea with the sclerotic coat. The surface of the cornea, when examined by an unassisted eye, appears smooth and even; but under a lens, as was first noticed by Sir David Brewster, it is seen to be broken up by elevations and depressions. The perception of distant objects becomes confused, and eventually is lost; at the same time small objects are with difficulty distinguished at a moderate distance, and, as the disease proceeds, a nearer and

Fig. 293.



nearer approximation of them to the eye is necessary, to enable the patient to distinguish them; and, at last, they cannot be recognised at all. Before useful vision is entirely lost, patients can only perceive objects when held very close to the eye and to one side. It has been observed that before the change in the cornea is very much marked, there is an unusual lustre and brilliancy of the eye, which, in a well-lighted room at night, has been compared to the sparkling of a diamond, and adds exceedingly to the expression of the eyes.

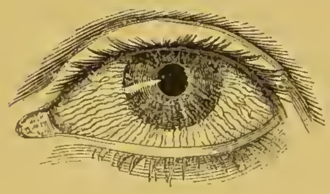
Causes.—The recorded experience of several authorities, namely, of Dr. Farre, Mr. Tyrrell, Mr. Square of Plymouth, and others, leaves little doubt that, in some cases, excessive weeping has been the exciting cause to which the disease was traceable; and it has been remarked, that congestion of the eyes, combined with compression of the globes, is highly favourable to the development of the disease. From the observations of Dr. Fr. Jaeger of Vienna, of Mr. Mackenzie of Glasgow, of Dr. Jacob of Dublin, and of Mr. W. White Coooper of London, it appears that this disease, in some circumstances at least, is a result of true corneitis, more especially in persons of an enfeebled constitution with a low condition of nervous energy. The cornea being rendered opaque and enfeebled by the inflammation, yields in the course of time to the pressure of the contents of the eye, and the opacity disappears. In several cases in which opportunities have occurred of examining the state of the cornea after death, it has been found of the usual thickness at its circumference, but very much thinner at its apex, and the laminæ less movable than natural.

Treatment.—If the views above stated be correct regarding the cause of this disease, the proper treatment consists, first, in the removal of the corneitis, and afterwards in endeavouring to prevent increase by the use of local stimulants, together with suitable treatment for the general health. Some ophthalmic surgeons have thought that this treatment, where it was not successful in diminishing, yet retarded the increase of the prominence. Dr. Pickford has published an account of cases in which relief was obtained by a course of purgatives and emetics. Tonics, with counter-irritation, have also been used, and, some have thought, with advantage. Removal of the crystalline lens has been resorted to, with the view of diminishing the refractive power of the eye; but although in one case, operated upon by Sir William Adam, the sight was improved, still the proceeding has not been found useful. Mr. Tyrrell has in some cases had recourse to alteration of the position of the pupil, so that it may not be opposite to the part where the cornea is most changed. He effects this by puncturing, with a needle, the cornea near its circumference between the outer and under aspect of the eye; he then introduces a hook through the wound, draws down the pupillary margin of the iris, and brings a small portion of it through the wound, so as to draw down the pupil; and the object then is to obtain adhesion of the iris to the wound in the cornea.

SCLEROTITIS, OR RHEUMATIC OPHTHALMIA.

Symptoms.—The *pain* is of a severe, agonizing, dull, pulsative character, affecting not only the eye, but the temple and all the parts around the orbit, constituting what is called the circumorbital pain. It is attended with a most distressing sense of fulness in the eyeball and tenderness on pressure, and has this distinguishing peculiarity, that although unceasing, it is greatly aggravated during the night. There is *redness*, which on examination is found to be of a dull character, and formed of small vessels under the conjunctiva, not obedient to the movements of the conjunctiva; and instead of being reticulated as in conjunctivitis, it is *radiated* or *zonular*. There is haziness of the cornea, and dimness of vision; and the movements of the pupil are sluggish. There is no lachrymation; on the contrary, patients complain of a feeling of *stiffness* and *dryness*; there is little intolerance of light, and the pupil is but very slightly contracted. The disease is often conjoined with inflammation of the conjunctiva, constituting catarrho-rheumatic ophthalmia; and in this case there is profuse lachrymation, great intolerance of light, and the sandy pain. Occasionally it is attended with some degree of iritis, and in this state also there is intolerance of light, and the pupil is generally more contracted. A considerable degree of irritative fever usually accompanies this disease.

Fig. 294.



Seat of the Disease.—The inflammation has its seat in the sclerotic coat and in the tunica albuginea; but frequently other textures, such as the conjunctiva and iris, become also involved.

Treatment.—In this disease, constitutional as well as local treatment is necessary; the former consisting, especially in severe cases, or where there is constitutional disturbance, in the employment of purgatives, antimonials, low diet, and calomel and opium at bed-time; the latter, in that of local depletion by leeches, warm fomentations, blister on the back of the neck, or behind the ear, and the application of belladonna to the temple and around the eye at night.

CATARRHO-RHEUMATIC OPHTHALMIA.

Seat of the Disease.—Both the sclerotic coat and the conjunctiva are involved, and are usually attacked simultaneously; hence the disease is said to be a compound of sclerotitis and conjunctivitis. It very frequently extends also to the cornea and iris, producing results by which vision is in many cases greatly impaired, and in some instances entirely lost.

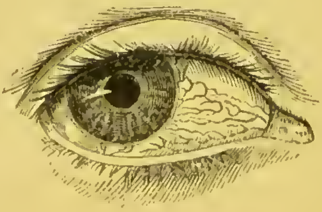
Symptoms.—In this disease the patient has, as in cases of conjunctivitis, the sandy pain, or the feeling of sand between the eyeball and eyelids; reticular redness, constituted by vessels movable on moving the conjunctiva; lachrymation; discharge of mucus, very rarely of pus; adhesion of the eyelids in the morning; intolerance of light; swelling of the palpebræ, and sometimes chemosis; and, as in cases of sclerotitis, the agonizing circumorbital pain, and pain in the eyeball; a feeling that the eyeball is too large for the orbit; the radiated or zonular redness, deep-seated, and formed by vessels which are not obedient to the movements given to the conjunctiva; a feeling of stiffness and tenderness on pressure; and violent irritative fever. If there be chemosis, it may be impossible to perceive the radiated or zonular redness. The pain proceeding from the sclerotic coat, although unceasing, is greatly increased during the night; the sandy pain is, on the other hand, greatest in the morning. The cornea is exceedingly apt to be involved, becoming the subject of ulceration, or of onyx or effusion of pus between its lamellæ—a very alarming condition, as the pus of an onyx in this form of ophthalmia is very rarely absorbed. The iris also is very frequently involved; its colour changing, the motions of the pupil becoming sluggish, and the pupil contracted. If the disease does not subside, there is great danger of the pupil becoming obliterated. Such are some of the distressing results in unfavourable cases of this disease.

Treatment.—In addition to the treatment for sclerotitis already described, it is necessary, on account of the affection of the conjunctiva, to resort to the remedies proper for conjunctival inflammation, namely, scarification of the conjunctiva over the sclerotic coat (and the greater the chemosis, the greater is the necessity for this proceeding), the use of the solution of the nitrate of silver, and touching the margins of the eyelids at bedtime with the ointment of red precipitate, prepared as formerly directed.

CHOROIDITIS.

Symptoms.—An important symptom of this disease is alteration of the colour of the white of the eye, the alteration being usually proportioned to the severity and advancement of the disease; the white of the eye is changed to a bluish or purplish hue, produced by the choroid coat shining through the attenuated parts in front of it. There is redness which presents the peculiarities of not being perceptible over the whole of the white of the

Fig. 295.



eye, but confined to one aspect, and of having the appearance of being formed by a broad set of vessels branching out towards the conjunction of the sclerotic coat and the cornea. In the course of time protrusion takes place at the discoloured part. The cornea usually becomes slightly opaque, but the opacity is generally confined to the aspect towards the protrusion. Displacement of the pupil is a remarkable symptom; and in some cases it occurs to such a degree as to bring the pupil nearly behind the corneal conjunction. Pain, in the early stage, is sometimes very slight, but when the distension and swelling of the eye become considerable, it is perfectly agonizing in the eye, and, in most cases, over the side of the head also, constituting what is called hemicrania. There is intolerance of light and epiphora. The vision is very differently affected in different cases; in many it is impaired by dimness, before any other symptom is perceptible; in some it is soon entirely lost; and in others, it remains to a considerable degree for some time after the eyeball has become enlarged and its colour altered. The appearance of flashes or sparks of light called photopsia, and that partial defect of vision called hemiopsia, the peculiarity of which is, that only half or part of an object can be distinguished at a time, are both often early symptoms.

Treatment.—The principal remedies are, in some cases, purgatives, which are especially serviceable; antimonials, and the vapour bath; local depletion by leeches, which, in order to be beneficial, must be very copious; counter-irritation; and when the disease has become chronic, if the distension be great, paracentesis oculi through the sclerotic and choroid coat, in order to evacuate the watery secretion underneath the latter, and between it and the retina. When the active stage is over, the use of tonics, more especially the preparations of quinine and iron, either alone or combined, is resorted to with advantage.

RETINITIS.

In the acute form of this awfully painful disease, the outward appearances of inflammation are not perceptible, until other textures have become involved along with the retina. The patient at first feels an unpleasant sensation of pressure and tension, which is soon succeeded by most excruciating deep-seated pain. The pain is pulsating, aggravated by the recumbent posture, by the motion of the eye, or by the least motion of the body; it soon extends to the head, and becomes so great as to be almost intolerable, and even to produce delirium. The vision is very early diminished, and very quickly becomes more and more impaired, until it is lost. Intolerance of light is an early symptom, which, however, usually subsides before the pupil becomes closed. The patient complains of a most distressing and annoying sensation of fiery spectra, and I have known this symptom to continue even after the pupil became entirely closed. The pupil soon loses its black appearance, and closes without undergoing any alteration in its shape or situation; but before it closes, the retina is perfectly insensible to light. The iris undergoes changes of colour, which will afterwards be mentioned. The cornea loses its shining appearance, and the inflammation of the other textures of the eye becomes perceptible. In addition to these local symptoms the patient is distressed with violent symptomatic fever.

Treatment.—Purgatives, antimonials, and the use of mercury so far as to affect the system, are the general remedies; and local depletion by leeches, rest of the eye, exclusion of light, counter-irritation, and the application of belladonna, constitute the local applications; and they require to be employed with the greatest promptness and followed out very energetically; otherwise, total loss of vision is likely to be the result.

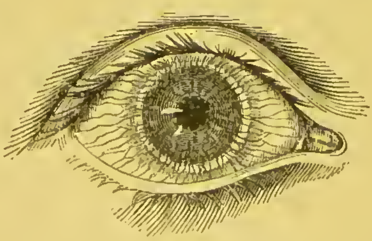
IRITIS.

Iritis, or inflammation of the iris, a very common affection, may be, as to its intensity, acute or chronic,—a distinction of great importance; as to its origin, idiopathic or traumatic; and as to its cause, it may be unconnected with any constitutional affection, or it may be induced and modified by some specific taint or diathesis, especially by syphilis, scrofula, and the rheumatic and gouty diathesis. Though variously modified by these different constitutional causes, as inflammations of other textures often are, it is no doubt one and the same affection.

ACUTE IRITIS.

Symptoms.—Pain in the eye is commonly one of the early symptoms. In some cases the pain is slight, in others severe; and when the inflammation extends to the sclerotic coat, the patient suffers from circumorbital pain increased greatly during the night: this, however, does not depend on the iritis. Zonular redness around the margin of the cornea is a very characteristic symptom. It is produced by minute, closely compacted vessels in the sclerotic coat, running in radii from the margin of the cornea towards the orbital margin, deepest in colour close to the cornea. The extent and depth of colour are proportioned to the severity of the disease. Sometimes this zonular sclerotitis, as it has been called, is separated from the circumference of the cornea by a grey line, which in some instances encircles the whole circumference of the cornea, and in others only a part of it. The vessels of this zonular sclerotitis are not obedient to movements communicated to the conjunctiva; but when the conjunctiva becomes

Fig. 296.



involved, vessels of a much larger size are observable, having a reticulated arrangement, and being obedient to the movements communicated by the finger to the conjunctiva, and similar to those seen in conjunctivitis when that affection presents itself as a primary disease. Another symptom is dimness of vision increasing as the disease proceeds. For some time, objects are seen as through a piece of gauze or a mist; but the dimness may continue to increase until it ends in total blindness. Numerous grey or dark muscæ are perceived, which indicate that the inflammation has extended to the choroid coat, as will be understood from what has been previously mentioned. Intolerance of light is a usual, though not an invariable symptom, and when present, is accompanied with lachrymation.

Change of appearance and discoloration of the iris are striking symptoms. The first change is, that the iris loses its brilliancy and presents a dull appearance, "absorbing the rays of light instead of reflecting them," as an excellent author has remarked. The kind of discoloration varies according to the natural colour of the iris. If the iris be naturally grey or blue, it acquires a greenish hue; if brown, hazel, or dark-coloured, it changes but little in the early stage of the disease, but afterwards acquires a reddish-brown tinge. These changes are caused by the increased vascularity and the deposition of fibrin into its substance or on its posterior surface. Other symptoms observable about the iris are, that the pupil becomes contracted, its motion sluggish, and eventually perhaps entirely lost. Lymph is effused on the margin of the pupil and into the posterior chamber, and sometimes into the anterior; and there are adhesions of the iris to the capsule of the lens. The aqueous humour becomes turbid, and the cornea losing its sparkling appearance becomes cloudy and hazy. Such are the usual symptoms when the disease is confined to the iris, or when that texture is the focus of the inflammation; but when iritis is accompanied with inflammation of other textures, as the choroid, sclerotic or conjunctival covering, or the cornea, the symptoms will be mixed up with those of inflammation of the involved tissues.

Treatment.—The principal objects aimed at by treatment are, to subdue the inflammation; to prevent the effusion of lymph, and to promote its absorption when effused; to prevent contraction of the pupil, and to promote its dilatation when contracted; to prevent adhesions; and in many cases to subdue the pain, which is sometimes exceedingly distressing. The best means for fulfilling these indications are, local depletion by means of leeches; antimonials; the use of mercury, carried to an extent to affect the system, and that as speedily as possible, this being the most valuable remedy of all, not only for preventing the effusion, but also for promoting the absorption of lymph; the application of belladonna to the temples at night; counter-irritation by means of blisters behind the ear after depletion;

rest of the eye; exclusion of light; rest of body, and due regulation of the diet and of the bowels. Calomel is the preparation of mercury preferred, and for the purpose of diminishing the pain, as well as for other reasons, it is used in combination with opium.

CHRONIC IRITIS.

Symptoms.—The principal symptoms are, a dull condition of the iris, slight change of colour, sluggishness in the movements, and eventually perhaps a motionless condition of the iris, with irregularity and thickening of the edges of the pupil, adhesions to the capsule of the lens, and impairment of vision. From this it is evident, that for the purpose of distinguishing iritis from other inflammatory affections, the appearance of the iris, the state of the pupil, and the condition of the iris as to motion, are important points for observation.

Treatment.—The indications of treatment are best fulfilled by the use of mercury, which, however, is given more sparingly than in acute iritis, and is often advantageously combined with tonics, and the application of belladonna round the orbit. In recent cases, the benefit of giving mercury internally, together with the outward application of belladonna, is often very great; the one remedy, by dilating the pupil, keeps up tension on adhesions that may have formed, while the other weakens them by promoting absorption.

TRAUMATIC IRITIS.

Traumatic iritis may be the result of wound of the iris or of the lodgment in it of some foreign matter, such as a bit of stone, metal, or some other hard substance. This variety is always acute, and in addition to the usual symptoms of common acute iritis, there will be found others varying in different cases according to the nature of the injury exciting the inflammation. The treatment, therefore, will comprehend the use of remedies suitable for both these classes of symptoms. If the irritant be very small, it should be allowed to remain, unless its removal could be very easily effected; but when it is likely to cause destruction of the tissue, it should, if possible, be removed; otherwise the remedies for subduing the inflammation will be used with little advantage.

RHEUMATIC IRITIS.

The other forms of iritis are rheumatic, arthritic, syphilitic, and scrofulous. They are readily distinguished, and in addition to other remedies, require the treatment proper to the diathesis in which each takes place.

CATARACT.

Definition.—The term cataract (derived from *καταῤῥασσω*, *to break*, vision being broken or disturbed by this disease) is used to denote opacity, situated anywhere between the vitreous humour and the pupil.

Classification.—All cataracts are divided into two grand classes, namely, the true, comprehending all those which have their seat in the lens, the capsule, or both; and the spurious, comprehending those the situation of which is external to the capsule.

TRUE CATARACTS.

True cataracts, when classified with reference to their origin, are arranged into idiopathic, or those which originate spontaneously, and traumatic, or those which arise from injury; when with reference to their appearance, into milky, purulent, flocculent, radiated, amber, black, &c.; and when with reference to their situation, or the particular part affected, into lenticular, capsular, and capsulo-lenticular. This last arrangement is the most important one in a practical point of view; and for determining the kind of operative proceeding suitable, it is also necessary to attend to a division of lenticular cataracts based on consistence, namely, into *hard* and *soft*.

Symptoms.—The symptoms of cataract have, by an excellent authority, been arranged into the *subjective*, consisting of certain feelings experienced by the patient, and the *objective*, consisting of certain changes or conditions in the eye observed by the surgeon. The principal symptom belonging to the first class is impairment of vision: as this symptom is common to cataract, glaucoma, and amaurosis, its peculiarities in the case of cataract must for the purposes of diagnosis be minutely observed; they are the following:—At first the patient sees objects as if a thin mist, a cloud, or piece of gauze, intervened between the object and the eye. In the earliest stage this symptom is only perceptible in a bright light; and, consequently, during this period, although vision is impeded by mistiness in mid-day light, it becomes distinct in the evening, or in a room where the light is diminished by a curtain or thin blind; and a patient in a room, having, while he looks to the window, a distinct perception of the cloud between the object and the eye, loses it completely, and sees objects clearly, on turning his back to the window. The perception of mistiness is also removed by holding between the object and the eye a piece of stained glass, which diminishes the quantity of light. Other peculiarities are, that vision is more indistinct when objects are held directly in a line with the axis of vision than when they are looked at sideways or in a slanting manner; and that the confusion of vision is removed by the application of belladonna around the eye. In this early stage, then, the perception of mistiness is lost, and vision becomes distinct in a dull light, or when the pupil is dilated by belladonna, or when objects are looked at obliquely or slantingly; hence patients are observed at this period to diminish the light by shading the eye with the hand, and to hold objects above or below the axis of vision when they wish to see them with distinctness. As the disease advances, however, the defect of vision increases, and the dimness is perceived in all circumstances, though to a less degree under those conditions under which it was previously imperceptible: eventually useful vision is completely lost; but the patient does not become blind so as to be unable to distinguish light from darkness, as in some of the diseases afterwards to be described. The explanation of the above-mentioned peculiarities is the fact, that in the great majority of lenticular cataracts, opacity commences in the centre, and gradually but slowly extends to the circumference; and in the contracted state of the pupil, caused by exposure of the eye to a bright light, or when an object is looked at directly in front of the eye, the rays fall on the opaque portion of the lens; whereas, in a dull light, or when the pupil is dilated by belladonna, or when objects are looked at obliquely, the rays falling towards the circumference of the lens are transmitted by the transparent portion, and distinct vision is the result. In a very rare variety of lenticular cataract, opacity commences at the circumference, and in such cases vision is rendered more confused in a dull light, or by dilating the pupil. Two other points important to be kept in view for arriving at a correct diagnosis are, that objects which are seen are in no case iridescent, and that the obscurity does not vary on different days, but in similar circumstances remains constantly the same. Such are the subjective symptoms, as they have been called, or those referable to the feelings and perceptions of the patient. The principal objective symptoms, or those observable by the surgeon, are the following:—On examination, the pupil, instead of presenting its natural black brilliant appearance, is observed to be of a greyish or whitish colour, which, in the great majority of cases, is most distinctly seen in the centre, and imperceptibly blends with the surrounding transparent structure. As the disease advances, this opacity increases in density, and extends more towards the circumference. It can be detected with the pupil in its natural condition; but, for a thorough examination, the pupil should be dilated with belladonna. The colour and site of the opacity should be carefully observed; in lenticular cataract, the site is immediately behind the pupil, whereas in some other affections of the eye, as, for example, in glaucoma, it is a considerable distance behind the pupil, appearing deep in the vitreous humour. In lenticular cataract, the dark shadow of the iris may be seen presenting the appearance of a ring surrounding the opacity. These peculiarities, if the form of the opacity be neither convex nor concave, and its appearance nearly uniform, indicate that the cataract is lenticular, and, if the colour of the opacity be amber or dark grey, that the lens is hard; if it be light grey, that it is soft. If the form of the opacity be convex, the site of the cataract is the anterior portion of the capsule, and in that case it appears immediately behind the pupillary margin, and presents a dull white, never a glistening appearance. If the opacity be concave, the posterior portion of the capsule is the site of the cataract, which will then appear at a considerable distance behind the pupil, and will be further distinguished by opaque streaks radiating from the centre. The iris retains its mobility in cataract, but does not in general exhibit any of that tremulous motion which is so often found connected with congenital cataract, where it is usually met with in combination with oscillation of the eyeball. There is a mode of examination by the reflection of light, proposed by M. Sanson, and called the *catoptric test*, which should not be omitted, as it furnishes the means for diagnosis between cataract, glaucoma, and amaurosis. For the application of this test, the pupil should be dilated by belladonna, and the patient placed in a dark room. "When a lighted taper is moved before the eye of a healthy person, three images of it may be observed. First, the erect image, that moves upwards when the candle is moved upwards, and that is produced by reflection from the surface of the cornea; secondly, another erect image, produced by reflection from the anterior surface of the crystalline lens, which also moves upwards when the candle moves upwards; and thirdly, a very small inverted image, that is reflected from the posterior surface of the crystalline lens, and that moves downwards when the candle is raised upwards. Now in cataract, the inverted image is from the first rendered indistinct, and soon abolished; and the deep erect one is soon afterwards abolished also." In glaucoma, the deep erect image is even more evident than in the sound eye, and it is only in the very advanced stage that the inverted image is obliterated. In amaurosis, all the images are as distinct as in the healthy eye.

TREATMENT OF CATARACT BY OPERATION.

As long as useful vision is enjoyed by one eye, it would be injudicious to resort to operation; but when useful vision is completely lost, the cataract being what is called matured, the eye being in other respects perfectly sound, the general health good, any inflammatory tendency or plethoric state of the general system which may have existed having been removed, the stomach and bowels being in a proper state, the patient having been kept at rest for some days, the diet restricted, and a few doses of saline purgative medicines having been taken at intervals, recourse may be had to operation. It will not, however, be prudent to operate on the second eye until some time has elapsed after the operation on the first. We shall refer to three different operations for the cure of cataract, namely, the operation of *Extraction*, that of *Displacement*, and that of *Division*. As no one of these is of universal application, as each has its advantages, disadvantages, and dangers, and as each has its peculiar recommendations in certain circumstances, it is requisite that all three be distinctly understood.

OPERATION OF EXTRACTION.

This is particularly suitable for the removal of hard cataract; and indeed it is the only operative proceeding proper for that purpose. It has this recommendation, that, when successful, it effectually removes the cataract; but, unfortunately, there are various conditions, both local and general, of not unfrequent occurrence, which would render it so extremely difficult or hazardous, that they are considered as decided contra-indications; and this operation, therefore, is properly restricted to a limited class of cases.

The local conditions which contra-indicate this operation even in cases of hard cataract are the following: Adhesions of the iris to the cornea, or to the capsule of the lens; a small size of the anterior chamber, either from natural conformation or from the iris being pressed forward by a large, although hard lens; so small a palpebral aperture as to render it impossible to expose the globe of the eye sufficiently; a deep position of the globe in the orbit—a condition which, as well as that last mentioned, would prevent the surgeon from making the section of the cornea in a proper manner—preternatural contraction of the pupil, called myosis (from μυω, *occludo*), and its remaining small after the application of belladonna; a soft condition of the globe, which indicates a fluid state of the vitreous humour—a case in which an operation would be followed by the immediate or gradual escape of that humour, and consequent complete destruction of the eye—or a very unusual degree of firmness of the globe, which indicates a great excess of vitreous humour. Of the general conditions contra-indicating extraction, the principal are, a very inflammatory, or a very irritable system, either of which would be likely to induce inflammatory destruction of the eye; a very feeble state of body, which would in all probability prevent the necessary process of adhesion; cough, asthma, or any condition of the lungs or heart, attended with difficulty of respiration. Any of these last-mentioned conditions would be apt to cause escape of vitreous humour, or protrusion of the iris; and, consequently, the operation in such cases would be very hazardous.

Only two instruments are required for this very delicate operation, the knife and the needle, bent at the point and fixed in a handle, or the curette. The knife usually employed is that of Beer, of Vienna. The pupil being very moderately dilated, the patient seated in the erect posture, and the right eye covered by a bandage, if the left eye is to be the subject of operation, the surgeon places himself in front of the patient, and proceeds with the operation. This has been divided into three stages; namely, 1st, Opening the cornea with the knife; 2nd, Opening the anterior hemisphere of the capsule; and, 3rd, Extracting the lens, technically called the exit of the lens.

The assistant stands behind the patient, holding his head, opening the upper eyelid with the fore and middle fingers, and assisting at the same time in fixing the eye by gentle pressure on the globe. The surgeon then depresses the lower eyelid, and further assists in keeping the eye steady by the fore and middle fingers of his left hand, the middle finger resting on the caruncula lacrymalis. The knife being held as a pen, with the edge upwards, its point is inserted on the temporal side of the cornea, close to the transverse axis of the cornea, at the distance of about the twentieth of an inch from the sclerotic coat; and lest the knife should be sent between the lamellæ of the cornea instead of into the anterior chamber, it should, until it enters the anterior chamber, be held perpendicular to the surface of the cornea, as if the object were to send it against the iris. Penetration of the cornea having been effected—in other words, the point of the knife having been sent into the anterior chamber—the handle is then directed towards the temple, so as to make the blade of the knife parallel to the iris, and the knife is then steadily pressed on until it reach the point of exit, and counter-punctuation be effected; then, the eye being still commanded by the surgeon, who now brings down his middle finger to the lower eyelid, and directs the assistant to remove the pressure from the globe, the knife is carried on until section of the cornea be accomplished. This finishes the first stage of the operation. The moment the section of the cornea is completed, the upper eyelid should be allowed to fall down, the eyelids to close, and the eye to rest for a few seconds. The errors to be guarded against during this stage are, sending the knife between the lamellæ of the cornea instead of into the anterior chamber, wounding the iris with the point of the knife on completing punctuation, injuring the nose by not holding the handle sufficiently back to the temple after counter-punctuation has been effected, wounding the iris by the edge of the knife in completing the section of the cornea, or in carrying the knife onwards to the point of exit, and attempting to complete the flap by cutting a flap either by raising the knife, or indeed by any proceeding except that of sending it directly onwards after effecting counter-punctuation. The sending the knife onwards completes the flap, whereas the consequence of endeavouring to cut a flap would be to separate the back of the blade of the knife from the uncut portion of the cornea below, thus allowing the aqueous humour to escape, and thereby causing the iris to fall forward on the edge of the knife. Too much pressure on the globe would also send forward the iris. The eyelids should then be gently opened, and the capsule divided in a crucial form by the needle or the curette, the greatest care being taken not to touch the iris. This finishes the second stage. The eyelids should again be allowed to close for a few seconds, during which time the patient must be careful not to compress the eye by straining or pressing with the lids. The surgeon then raises the upper eyelid with the thumb of his left hand, directs the patient to look down towards his nose, and in the gentlest manner possible presses on the upper part of the eyeball, and thus dislodges the lens, sending it through the pupil into the anterior chamber, and thence through the section of the cornea, after which a very accurate adjustment of the edges of the cut portion of the cornea is to be effected, and the eyelids closed; and this finishes the third or last stage of the operation. The pressure by which dislodgment is accomplished must be applied with the utmost caution, and discontinued as soon as the greatest diameter of the lens is through the pupil, lest otherwise the hyoloid membrane should be ruptured, and the vitreous humour allowed to escape. Both eyes should be covered with a very light covering, consisting of not more than three or four folds of soft, thin linen, secured by a single turn of a bandage or ribbon, to which the folds of linen should be fixed. By these appliances the eyelids will be preserved motionless and closed. The patient should be placed in bed, lying on his back, with the head and shoulders elevated; and this position must be continued for some days: he should be careful to avoid sneezing, or coughing, or holding down his head; his food must be of the most unstimulating nature, and given for some days in extremely small quantity, and in such a form as not to require mastication; every judicious means should be taken to prevent inflammation, or to subdue it, if it should supervene; the eyelids should not, if possible, be opened for five or six days; the patient should be kept in a dark room, and every cause of excitement avoided; and not before two weeks at least, even in the most favourable cases, should the eyes be exposed to the stimulus of light; and even then, with the utmost caution, and only to a dull light.

DISPLACEMENT.

The operation of *displacement*, formerly called *couching*, the most ancient operation for cataract, should only be performed in cases of hard cataract, in which extraction is contra-indicated by some of the conditions already mentioned. We shall refer to two varieties of this operation, namely, *depression*, and *reclination;* the object aimed at in each being the removal of the opaque lens from the axis of vision. Each operation consists of three stages, the first and second of which are common to both, and shall therefore be first described; and afterwards we shall explain the mode of proceeding in the third stage of each separately. The instrument generally preferred for these operations is Scarpa's needle. The pupil having been dilated by belladonna, the patient placed on a low chair, with his head, upper eyelid, and eyes secured by an assistant, as in the operation of extraction, the surgeon, seated on a chair higher than that on which his patient sits, holds the lower eyelid and the eye by the fore and middle fingers of one hand, takes hold of the needle as he would of a pencil with the right hand, if the operation is to be performed on the left eye, but with the left if on the right eye, and holding it horizontally with the convexity upwards, inserts it about one-sixth of an inch behind the corneal conjunction, precisely in the central transverse axis of the eye, and gently sends in the needle until the lance-shaped part of it has passed through the choroid into the vitreous humour. This completes the first stage of the operation. The above-mentioned distance from the corneal conjunction is selected to avoid the ciliary processes on one hand and the retina on the other; and the central transverse axis, to avoid the two branches into which the long ciliary artery divides about three-tenths of an inch behind the margin of the cornea. In the second stage, the point of the instrument is made to divide the whole posterior hemisphere of the capsule; it is then brought under the lens into the posterior chamber, and the point of the needle, formerly turned forward to divide the posterior portion of the capsule, is, while in the posterior chamber, directed backwards, and the whole anterior hemisphere of the capsule is divided. This completes the division of the capsule, and the second stage of the operation. The third stage of depression is commenced by placing the concavity of the needle on the upper part of the lens, and then by gentle manipulation the cataract is pressed downwards, and a little outwards and backwards into the vitreous humour. The needle should not be moved for a minute or two; and before withdrawing it, the operator should carefully observe that the cataract does not re-ascend, lest it should be necessary to depress it again. If reclination be the operation to be performed, the concave part of the needle is placed against the front of the lens, a little above its centre, and by gentle manipulation is made to fall backwards and a little downwards, and outwards. It is thus made to recline or fall back, its anterior surface being turned upwards.

OPERATION OF DIVISION.

The operation of division—named also the operation for promoting absorption, and the operation for dissolution of the cataract—is suitable for cases of fluid, and also of soft cataracts, and may be performed by division either through the sclerotic coat or through the cornea. The object aimed at in this operation is to subject the cataract to the influence of the aqueous humour, which has the property of dissolving it. The mode of admitting the humour into contact with the lens for the accomplishment of the desired solution, differs in the two varieties of the operation. Except in the case of fluid cataract, the operation requires to be performed more than once; but, when properly performed in suitable cases, it seldom fails to produce the desired result.

Division through the Sclerotica.—The patient should be as carefully prepared for this operation as for displacement, and the eyelids and eye secured in the same manner. The same instrument is used, and the operations are in all respects the same until the needle is introduced into the posterior chamber. The convexity of the needle should then, by a partial revolution on its own axis, be directed forwards, and in that position sent inwards, until it is distinctly seen through the pupil; when by cautious manipulation, the front of the capsule, over a space rather larger than the natural size of the pupil, should be cut into shreds. Complete mutilation of the capsule, to this extent, is desirable. Mere penetration would not be sufficient, as re-union might take place; and, on the other hand, to destroy the whole anterior portion of the capsule would be imprudent, as the lens might then fall forward on the iris. If the cataract be fluid, it will escape into the aqueous humour, cause a cloudy appearance, and be ultimately absorbed, and no further operation will be required. The surgeon should content himself with the mutilation of the capsule at the first operation, and in two or three months the needle should be again introduced, and carried inwards in the same manner; and then by gentle movements with the needle, part of the lens may be broken down, and if perfectly soft, be sent through the pupil into the anterior chamber. In using the needle to break down the lens, it is very necessary not to send its point too far back, lest the posterior portion of the capsule be wounded, which would lead to opacity, and thus constitute capsular cataract.

Division through the cornea, named *keratonyxis,* is by many considered less hazardous than division through the sclerotic coat, inasmuch as fewer coats are wounded. The pupil must be previously dilated; the needle should be of a smaller size, having the round part, which is in the wound of the cornea during the last stage of the operation, of increasing thickness, so as to prevent escape of the aqueous humour. The needle should be introduced one-eighth of an inch from the margin of the cornea—the temporal aspect being in general the most convenient—and sent through the pupil. At the first operation, the surgeon should not do more than effect mutilation of the capsule to an extent equal to the size of the pupil. In the course of a few weeks the operation may be repeated, and a portion of the lens having been broken down by lateral movements with the needle, the fragments may be brought forward by movements of the needle, with its concavity forward. In this as in the former operation, care must be taken not to wound the posterior hemisphere of the capsule.

Division by drilling.—This modification of the operation of division was first suggested and practised by Mr. Tyrrell, who considers it particularly adapted for cases of capsular or capsulo-lenticular cataract, produced by extension of inflammation from the iris to the capsule, in which adhesions have been produced. A fine, straight needle is sent through the cornea near its margin, and, passing through the pupil, is made to penetrate the capsule and enter the lens to the depth of about one-sixteenth of an inch; the handle is then made to rotate between the finger and thumb, so as to make the point act as a drill, after which the instrument is withdrawn. The operation is repeated in the course of a few weeks, and on each repetition of it a new part of the capsule and the lens is selected for the drilling.

SPURIOUS CATARACT.

Spurious cataract is constituted by effusion of coagulable lymph, as a result of inflammation of the iris, and of the capsule of the lens. If the lymph have a flocculent appearance, it is termed flocculent fibrinous cataract; if that of a small white clot adherent to the pupil, and generally also to the capsule, the term is clotted fibrinous cataract; if it consist of a bar extending across the pupil, it is called trabecular fibrinous cataract; if purulent matter be entangled in the lymph, purulent cataract; if blood be entangled in it, sanguineous cataract; or if part of the membrane which retains the pigmentum nigrum become detached in consequence of injury, and adherent to the capsule which is rendered opaque by inflammation, induced probably by the same injury, it is termed pigmentous cataract.

THE OPHTHALMOSCOPE.

It is almost impossible to over-estimate the advantages which have already resulted from what that truly great ophthalmic surgeon, Mr. Bowman, has called "the immortal invention of the ophthalmoscope by Helmholtz." An excellent writer has given the following description of this instrument, and the principle of its operation:—

"The ophthalmoscope, in its simplest form, is a concave circular mirror of about ten inches focus, made of silvered glass or polished steel, and having a hole in the centre. As an appendage there is needed a convex lens an inch and a half in diameter, with a focus of from two and a half to three inches, set in a common eye-glass frame with a handle three inches long. The investigation must be made in a dark room. The patient's pupil should be dilated as a rule. The light of a candle is hardly sufficient, certainly not for beginners. An oil lamp is better, but by far the best is an argand burner that slides on a vertical rod.

"The patient sits by a table, and the lamp is placed by his side close to his head, with the flame on a level with the eye, from which it is screened by a little flat plate of metal attached to the burner. The operator sits directly in front; and, holding the instrument close to his eye, and a little obliquely to catch the light from the lamp, he commences at the distance of about eighteen inches from the patient, to direct the reflection on the eye. When this is got, the convex lens must be held at the distance of two and a half inches from the eye and the focusing commenced, by moving them slowly backwards and forwards. When the light fairly enters the eye a reddish glare appears, and as it is focused, an orange-red or orange-yellow is seen; then the blood-vessels of the retina come into view. The retina itself presents a whitish aspect, through which the choroid is more or less discernible. The entrance of the optic nerve should now be sought; probably a part of it will already have been seen as a whitish spot; but the way to discern it properly is to make the patient look inwards. It appears as a whitish circular spot, in the centre of which are the central vein and artery of the retina, giving forth a variable number of branches, usually six or eight. The convex lens is not usually needed for examining near-sighted eyes, nor, in general, for the anterior structures of the eye. But what is the principle of the ophthalmoscope; why is a reflector needed; why cannot the eye be illuminated with the very lamp from which the light is borrowed? When a stream of light is thrown into the eye, the rays are reflected back by the retina and choroid, and, returning as they enter, are brought to a convergence at the spot whence they emanated. This takes place when any luminous body is held before the eye; hence when a candle or lamp is used, we see no illumination, simply because the flame is in the focus of reflection, and our eye cannot be there too, nor can it see through the flame. This difficulty is overcome by using a mirror with a hole in the centre (the ophthalmoscope), which represents the flame, and, by looking through the hole, we place our eye in the centre of the reflection, and thus see the lighted interior of the patient's eye. It is possible, by certain arrangements of light and position of the beholder, that the eye may be to an extent seen illuminated; but for the full effect the ophthalmoscope is requisite."

The following are some of the many morbid appearances revealed by means of the ophthalmoscope. The optic disc, instead of presenting its distinct circular form and bright white colour, and perforated by three or four arteries entering and as many veins leaving the eye, may be seen in a state of hyperæmia, the vessels being in some cases injected to an extent to almost obscure the white appearance of the disc. This condition is not unusual in persons who strain the eye looking at minute objects. It may present the appearance of black pigmentary bodies on its surface or at its circumference; it may have blood effused on its surface, constituting apoplexy of the papilla, or it may present a convex or concave appearance at its centre. The last-mentioned form is indicative of intra-ocular pressure, and is met with in cases of glaucoma. Other morbid appearances of the disc are, an irregular jagged circumference, and atrophy, which is sometimes congenital in persons affected with strabismus. The macula lutea, instead of being distinguished, as in the healthy state, by the absence of retinal vessels, presents the appearance of small vessels, and is found to be the seat of hemorrhages, plastic exudations, and morbid deposits. The retina is often seen to have its transparency greatly impaired, its arteries enlarged with plastic exudation or hemorrhage in their course, the veins in a varicose state; and serous effusion has been distinctly perceived between the retina and choroid coat; the retina having the appearance of lying in folds, or of floating on the fluid. Desmarres has described an œdematous condition of the retina, which is believed to be a result of secondary syphilis. Cholestrine scales, a turbid appearance, and hemorrhage are the chief morbid appearances that have been seen in the vitreous humour. The choroid coat is seen to present many deviations from its healthy appearance, some of which are—great hyperæmia, a bright scarlet line-absorption of pigment at some parts, giving rise to a whitish appearance, and black deposits; at others, especially around the optic disc, great variations of colour, serous, plastic, or sanguineous deposits on its surface, and sometimes, although rarely, it is the subject of colloid degeneration. The above are some of the many morbid appearances that we are enabled to see by the aid of the ophthalmoscope.

GLAUCOMA.

Glaucoma (from γλαυκος, *viridis*) is the name given to an affection of the eye, in which a greenish appearance is seen on looking into the pupil.

State of parts as ascertained by dissection.—The following are the abnormal conditions most frequently met with; no trace of hyaloid membrane; the vitreous humour pellucid, or slightly yellow, but in a fluid state; no trace of limbus luteus, or of foramen centrale in the retina; little or no appearance of the pigmentum nigrum; the choroid coat of a light brown colour; and the lens, although still transparent, or nearly so, of an amber yellow, or reddish brown colour. The opinion entertained by some authorities is, that glaucoma originates in inflammation of the hyaloid membrane, that this inflammation ends in its destruction, and that this destruction produces a series of other changes in the eye.

Symptoms.—Gradual loss of vision; dilatation and sluggishness of the pupil; hardness of the eyeball; iris pressed forward against the cornea by the lens; a greenish appearance seated at a considerable distance behind the pupil, best seen on looking directly into the pupil, and disappearing entirely when the eye is looked at in profile; whereas in cataract the opacity does not disappear when looked at sideways. Before vision is lost, it is assisted by a strong light; and this is another diagnostic symptom between glaucoma and cataract. The catoptric test also assists in forming diagnosis; for in glaucoma the deep erect image is even more evident than in a sound eye; and it is only in the very advanced stage that the inverted image is obliterated. There are two forms of glaucoma—acute and chronic. The two differ chiefly in the severity and progress of the symptoms. By the aid of the microscope, pulsation in the central artery of the retina, a varicose condition of the retinal vessels, small clots of blood in the vitreous humour and in the retina, and an excavated or depressed state of the optic disc, may be observed.

Treatment.—The modern treatment of glaucoma is the only one that as yet has been of almost any service in this disease. It is the operation of iridectomy proposed by Von Graefe, and practised in many cases with the most gratifying results. In a most instructive and interesting communication on "Iridectomy in Glaucoma," by Mr. Bowman, in the "Medical Times and Gazette" of August 25, 1860, he writes:—"At present the operation is being extensively tried in cases where augmented intra-ocular pressure evidently exists; and the proved tendency of the operation to relieve the injurious tension, the certain cause of secondary mischief, makes it our duty to employ it, when the patient is otherwise apparently drifting into inevitable blindness. It may be our misfortune, and that of our patients, that our experience is as yet less complete than a few more years will make it; but, meanwhile, we can only act upon the light we possess, and store up the results for the future benefit of others."

The anterior chamber is entered at its extreme rim, where the sclerotic overlaps the cornea, and the iris excised to a sixth of its circuit. A mere puncture is quite insufficient. Mr. Bowman states that his opinion was, and is, that the more direct communication opened between the vitreous and aqueous regions facilitates the play of currents between them, and thus allows an excess of fluid behind to come forward to the corneal surface, through which exosmosis is much easier than through the posterior coats. It has been found most successful when employed early in acute cases.

AMAUROSIS.

Definition.—The term amaurosis is used to denote obscurity of vision depending on disturbance or change in some part of the nervous apparatus belonging to the organ of vision, or communicating with it, that is to say, in the retina, optic nerve, or brain.

Proximate Cause.—The principal causes of amaurosis are, structural changes in some part of the nervous apparatus connected with the organ of vision, occasioned by some grade of inflammation in the retina, optic nerve, or brain; changes in the retina induced by inflammation, scrofulous or malignant disease; pressure on its concave surface by vitreous dropsy; pressure on its convex surface by effusion from parts external to the retina; changes induced by pressure on the portion of optic nerve within the orbit,—a part which, although seldom the subject of disease commencing in itself, is occasionally compressed by results of inflammation, by tumours, or by aneurism within the orbit; inflammation or congestion within the cranium, or products of inflammation having its seat in the membranes of the brain, or in the portions of brain connected with the organs of vision; tumours, extravasated blood, and softening of parts of the brain connected with the optic nerve. Such are the principal conditions on which amaurosis depends; but any state which makes the retina incapable of receiving with correctness the impressions of external objects, or the optic nerve incapable of transmitting impressions received on the retina, or the portion of brain connected with the optic nerve unfit for receiving those impressions, may be a proximate cause of this disease.

Predisposing and exciting Causes.—The fact that several members of the same family have, in successive generations, become affected with amaurosis, is strong evidence that hereditary predisposition is one cause of it. Some of the most respected authorities are of opinion that the form of amaurosis, which is most frequently observed to be hereditary, is that which depends on organic disease; that it is more frequently met with in elderly than in young persons, and in females than in males; that it is most common in individuals with black irides, and that it is seldom confined to one eye. Long-continued over-exertion of the eye, especially long-continued perception of minute or luminous objects, has often been found to be an exciting cause of this disease; and the form thus induced is usually the congestive variety. This variety is most common in persons with light-coloured or blue irides, and it occurs in the majority of cases at an earlier period of life than that which arises from organic disease. Literary men, engravers, watchmakers, and tailors, are often the subjects of this variety. Vascular fulness in consequence of the arrest of some inordinate discharge, or long-continued evacuation, or in consequence of over-exertion, or the use of wine or spirits, furnishes in many cases an exciting cause. In some cases the disease has been known to be caused by wounds of the forehead or near the orbit, and not on the eye itself; and in others, by a single injudicious exposure of the eye to an exceedingly bright light, the sensibility of the retina being thereby destroyed. In some instances, injury and irritation of some of the branches of the fifth nerve have been found to be the exciting cause, the rationale of which cannot be easily explained; and in others, long-continued gastric and intestinal irritation, typhus fever, great exhaustion caused by some excessive evacuation or by long-continued discharge, and debility from great mental anxiety, have operated as exciting causes.

Symptoms.—These are numerous and varied. Of the subjective symptoms, those which are referable to the feelings and perceptions of the patient, the principal are the following:—Impairment of vision, or some defect in the perception of objects. The impairment may vary from slight weakness of sight—called by some, imperfect or incomplete amaurosis; by others, amblyopia amaurotica—to total blindness, or what is called perfect amaurosis. Sometimes in the early stage the defect of sight is not permanent, but returns at regular or irregular intervals, constituting the amaurosis vaga of some authors. *Nyctalopia*, or day-blindness, and *hæmeralopia*, or night-blindness, are examples of periodic amaurosis. In general, however, the periodic soon changes into the permanent form. In some cases the failure of sight assumes the *myopic* or *presbyopic* form, that is, the person becomes short or long sighted. Both varieties are met with, but the latter is the more common. Occasionally, in the early stage, objects are seen covered with a dense mist, a symptom called *visus nebulosus;* and in some instances, this mist appears to the patient as a constantly-increasing cloud; in others, it appears at first of a light grey colour, and afterwards like dense black smoke between the eye and the object. In imperfect amaurosis, objects sometimes appear disfigured (*visus defiguratus*), lengthened, shortened, bent, and in some instances inverted. The flame of a candle sometimes appears very long, and, as it were, divided into several portions. Beer regards this as a very unfavourable symptom, his experience having led him to conclude that it is indicative of disease of the brain. In a case at present under my observation, the flame of a candle appears to the patient elongated and very much bent, without being divided into different parts. Other peculiarities are, that some patients see only half an object at one time; this symptom is named *visus hemiopia*. Some see parts of an object, other parts being concealed from view; for example, in looking at a word, some syllables —or at a line, several words—are seen at different parts; this is called *visus interruptus*. Others see objects only when held obliquely, or in certain directions; this is termed *visus obliquus*. Such are the principal defects of vision; but many amaurotic patients have illusive perceptions of objects, and these vary much in appearance. Sometimes the patient fancies he sees flies or gnats flying before his eyes; these appearances are named *muscæ volitantes;* and this peculiarity is called *visus muscarum*. Sometimes all objects appear as if obscured by a network or gauze; a symptom termed *visus reticulatus*. This network usually presents a white, shiny, silvery appearance in dark places, or when black objects are looked at; and a dark appearance in light situations, or when white objects are looked at. Objects are sometimes seen of wrong colours; this is called *visus coloratus;* and in many examples of amaurosis, a very distressing symptom is the perception of fiery balls or bright flashes of light passing suddenly before the eyes when the eyelids are shut; this is called *photopsia;* it is an early symptom, is most common in plethoric persons, and is usually attended with considerable alarm. Some patients, in the early stage, dread the light—a symptom called *photophobia*; whilst others have what has been called "a thirst for light," and a desire for a great degree of illumination of objects. The above are the principal symptoms referable to impairment and perversion of sight. Sometimes in amaurotic cases there is a feeling of weight about the eye; sometimes pain in the eye and in the neighbouring parts of the face, in the brow, or in the head; sometimes patients have an unpleasant feeling of dryness in the eye and nostrils; and in some cases the disease is accompanied with giddiness, dizziness, tinnitus aurium, and a sense of fulness in the head, aggravated by exercise and the horizontal posture. The seat and peculiarities of the pain, and the history of the patient's health, will furnish important information both for diagnosis and treatment.

The principal objective symptoms, or those which are discoverable on examining the patient, are the following:—In the early stage the pupil is in general sluggish and limited in its motion, and, in the advanced stage, dilated and motionless. This, however, is not invariably the case; for in some examples of perfect amaurosis of both eyes, the pupils have been found to vary in size according to the degree of light; and in others of complete darkness, where one eye only was affected, the pupil of the amaurotic eye has been found to change as in health, according to the degree of light admitted to the sound eye. This suggests the propriety of covering the sound eye, while the other is under examination. Generally, however, notwithstanding the above peculiarities, the early and advanced stages are attended with the conditions of the pupil already mentioned. In some instances the pupil has its natural black appearance, more especially in cases depending on affections of the brain; but more commonly it has somewhat of a cloudy or glaucomatous appearance. The patient does not converge his eyes towards objects placed before him. The application of the catoptrical test should never be omitted; it shows the three images as in a sound eye. There is a vacant expression and a peculiar stare about the eye, together with an uncertainty in the movements of the patient, and a peculiarity of gait quite characteristic of the affection. By the above-mentioned symptoms amaurosis may be readily distinguished from cataract and glaucoma.

Treatment.—From what has been stated as to the exciting and proximate causes of amaurosis, the principles of treatment applicable to its different varieties, and the suitable means for carrying them out, will at once be evident; so that it appears unnecessary here to say anything further, than that it is only at the outset of the incipient stage, that any benefit can be expected from treatment even in the most favourable cases; and that without relinquishment of the exciting cause and perfect rest of the organ, the best-directed treatment in other respects will be of no avail.

EXTIRPATION OF THE EYE.

The patient having been placed on his back, or in a chair with the shoulder and head raised and supported, chloroform having been administered, and the charge of the eyelids given to an assistant whose duty it is to raise the upper eyelid by means of Pellier's speculum, and to keep the eyelids as much as possible out of the way of the knife during the cutting part of the operation, the operator disunites the eyelids from each other at the outer commissure by making a horizontal incision outwards for about half an inch beyond the orbit, so as to allow the wide separation of the eyelids; he then passes a large curved needle armed with a double, waxed ligature through the eye-ball from side to side behind the cornea, and having cut off the needle, ties the two ends of the thick strong ligature together. As the object of this proceeding is to obtain a suitable means of applying traction to the eye-ball while it is being detached from its surrounding connexions, the insertion of the needle should be so far back behind the cornea as to get hold of a part not likely to give way during the operation. Another mode of obtaining the command of the eye is by seizing it with a volsellum. A scalpel or bistoury is then inserted between the eyeball and the inner canthus, and carried between the eye and under eyelid and round the ball, so as to divide the conjunctiva, and then by a few sweeps with the knife the muscles are cut through and the optic nerve divided, the eye being drawn by the ligature in various directions to give room for the movements of the knife. Two points should be attended to in the cutting part of the operation, namely, to leave as little as possible of the optic nerve in the orbit, and if the future use of an artificial eye be contemplated, to leave as much conjunctiva as may be in a healthy state attached to the eyelids. Any hemorrhage may be easily commanded by the introduction of lint within the orbit. The edges of the wound made in disuniting the eyelids are brought together by a suture and an exceedingly light compress, and one or two turns of a roller are applied; after which the patient should be kept very quiet, and every judicious precaution taken to prevent the occurrence of any high degree of inflammation.

STRABISMUS.

Strabismus denotes that condition of the eyes in which the optical axes do not converge to the same point; of this there are two forms, strabismus convergens, in which the eye looks inwards, and strabismus divergens, in which it looks outwards, the former being the more common. This affection depends on a disturbance of the balance of action of the recti muscles, which disturbance may sometimes be caused by excessive action of one muscle, but in most instances it probably arises from one muscle being enfeebled, so as to be unable to resist its antagonist drawing the eye to the opposite side. This is rendered probable by the difference observed in the result when the internal rectus is divided by accident, and when divided in the operation for the cure of strabismus. In the former case, the eye is turned completely outwards, whereas in the latter, the external rectus usually brings the eye only into its proper position. Cases of strabismus proceeding from gastric, intestinal, or uterine derangement, from general debility, or from affections of the brain, are all unfit for operation; as also are all cases in which the deformity is in consequence of opacity in the cornea, the distortion in such instances being an effort to remove the opacity from the axis of vision. Cases fit for operation are those in which the strabismus is confirmed, and in which there is no evidence of an exciting cause calculated to keep up, or to bring back, a disturbance in the equilibrium of muscular action within the orbit.

The operation for strabismus is that which was first suggested by Stromeyer of Hanover, and soon afterwards practised by Diefenbach of Berlin, by Pauli of Landau, and in a short time by surgeons generally. Having performed it above one hundred times I feel myself justified in stating my firm conviction, that if only fit cases are selected, it will be found most satisfactory in its results. The object of operation in strabismus convergens is to divide the internal rectus, and in strabismus divergens, the external. There are many varieties as to the instruments which have been employed, and in some respects as to the mode of performing this little operation. With regard to instruments, nothing more convenient need be desired than Pellier's speculum for keeping up the eyelid, a double hook invented for this operation, a forceps for raising, and a small pair of scissors for dividing the parts. The operation for strabismus internus may be performed in the following manner :—The patient being placed in a chair, the upper eyelid raised by Pellier's speculum, the under eyelid depressed, and the eye drawn outwards by means of the hook fixed in the conjunctiva fully a line behind the cornea, the speculum and hook being both held by an assistant, the operator pinches up the conjunctiva with the forceps, and makes a vertical incision about half an inch in length, and fully from two to three lines behind the cornea. By a few snips with the scissors, the tendon is exposed and divided; and if, on removing the hook, the eye be slightly turned outwards at first, or the patient unable to turn it inwards to its former position, the operation may be considered perfectly satisfactory. I am sure that no better mode of performing this operation need be desired.

AFFECTIONS OF EYELIDS AND OF LACHRYMAL APPARATUS.

HORDEOLUM, OR STYE.

Hordeolum, a diminutive of hordeum, *barley,* is a name given to an inflammatory swelling near the margin of the eyelid on account of its usually being about the size of a small barleycorn.

At first the patient feels itching or slight smarting, but this soon gives way to pain, tenderness, tension, and great sensibility; the swelling, which at first is of a bright red, gradually becomes darker and of a purplish hue; the form becomes conical, and after pus has been formed, the apex presents a yellow colour. The swelling sometimes subsides without going on to suppuration; but in most cases it suppurates and bursts, after which the swelling in general very soon subsides and heals up; but sometimes it degenerates into grando; sometimes it returns in consequence of the whole of the matter not having been discharged; and sometimes its healing is retarded by the disorganized cellular tissue being long in coming away. In many cases hordeolum consists of a small acute abscess caused by obstruction, retention of the contents and consequent inflammation of a meibomian follicle.

With regard to treatment, the digestive organs should be carefully regulated, and a proper condition of their secretions promoted. A smart purgative, and cold applications in the incipient stage, will sometimes stop the disease. When the inflammatory process advances, these must be changed for emollient applications, as fomentations, simple or medicated, or light poultices; and when matter is formed, the abscess should be opened; after which tepid water-dressings may be continued, and if the disorganized cellular tissue be long in coming away, the healing of the part will be greatly promoted by touching the cavity with a small pencil of nitrate of silver.

PHLYCTENULA, GRANDO, AND MILIUM.

Phlyctenula, or a small semi-transparent vesicle formed by the cuticle near the margin of the palpebra being elevated by a portion of serum, is often observed. Sometimes there is but one vesicle, sometimes there are several; and they vary in size, but are not generally larger in volume than a small shot. The vesicle is apt to return, if it be merely opened; but if a considerable portion of it be removed by a snip of a pair of scissors, there is very rarely any return. Small white superficial painless swellings, formed by the skin being raised by a suet-like substance, are often met with in the palpebræ. When such a swelling is about the size of an ordinary hailstone, it is called grando; and when it resembles a millet-seed, milium.

All that is necessary for the cure of these swellings is to open the skin and press out the contents.

OPHTHALMIA TARSI, OR PROROPHTHALMIA.

Symptoms.—Itching and irritation in the ciliary margin are the first sensations; and as the disease advances, these give way to soreness, tenderness, and, if the disease be acute, to sharp pain. Soreness, slight feeling of heat, and stiffness, however, are the chief sensations after the disease has existed for some time. According to the degree in which the conjunctiva participates in the inflammation, the patient complains of slight lachrymation, weakness, intolerance of light, and a feeling of sand between the eyeball and eyelids. The eyelids are glued together in the morning by a viscid coagulated secretion; and the incrustation thus formed binds the edges so firmly together that they cannot be easily separated without much bathing. By injudicious efforts to separate the eyelids without previous bathing, the eyelashes are often drawn out. The edges of the eyelids become thickened and red as the disease advances. Some of the cilia at their bases are enveloped in coagulated secretion, on the removal of which small ulcers or pustules are observable. By the spreading of these ulcers the margins acquire a raw appearance, and the cilia become first irregular, and ultimately almost entirely removed, the surface being raw, swollen, and thickened. The eyes have what has been called a bleared appearance. At first the edges are inflamed and affected with small pustules or ulcers; thickening of the edges and irregularity of cilia next occur; and lastly the cilia disappear, and the edges present a raw appearance. It is believed that generally the meibomian follicles are first affected; but these, the roots of the eyelashes, the skin, and the conjunctiva, are all more or less involved; and loss of the cilia, obliteration of the meibomian follicles, thickening of the palpebræ, and eversion of the lower eyelid, are some of the sequelæ of this disease. The disease occurs in scrofulous subjects as a primary affection; but it is more frequently a consequence of some other disease, such as measles, scarlatina, catarrhal or strumous ophthalmia.

Treatment.—In the first stage, when acute, the treatment comprehends slight depletion by scarifying the palpebral portion of the conjunctiva, warm emollient or opiate fomentations, and very careful bathing of the eyelids before opening them. The scabs must be cleared away with much caution from the bases of the cilia. At a more advanced stage, the occasional use of astringent or stimulating collyria during the day, and the application of an ointment at night, constitute the proper treatment. The collyria generally preferred are weak solutions of sulphate of zinc, or nitrate of silver, or corrosive sublimate; and the ointments, that of the carefully levigated red precipitate of mercury mixed with fresh butter, or that of the nitrate of mercury very much diluted. The cilia sometimes require to be pulled out, when there is much ulceration around their roots; and sometimes much benefit is derived from touching the small ulcers very gently with the nitrate of silver. All sources of local irritation must be guarded against; the functions of the skin, stomach, and bowels attended to; and if the patient be scrofulous, the treatment for that diathesis must be instituted. When this disease has produced entire destruction of the cilia, with a thickened, florid, everted, and excoriated state of the edges of the eyelids, the condition receives the name of lippitudo.

ENTROPIUM.

Entropium is the name given to inversion of the eyelid, a condition which gives rise to—lachrymation; pain, especially in moving the eye; irritation, as if produced by a foreign body; intolerance of light; inability to use the eye; a degree of ophthalmia; nebulous opacity of the cornea, and impairment of vision.

Causes.—Entropium most frequently depends on an extremely lax condition of the common integument, in consequence of which the orbicularis palpebrarum is unable to preserve the lid in its proper position. Sometimes it arises from contracted cicatrix of the palpebral portion of the conjunctiva; a state which may follow ulceration, a burn, a wound, or destruction of the conjunctiva by an escharotic. A third condition which gives rise to it is, thickening of the conjunctiva at the junction of the ocular and palpebral portions; as the swelling presses the eyelid from the ball of the eye and causes inversion. In some instances swelling causes eversion, as was mentioned in the description of some of the forms of ophthalmia, and in others it produces inversion. A fourth and very troublesome cause of entropium is contraction of the tarsus, a condition not unfrequently induced by long-continued strumous ophthalmia.

Treatment.—When entropium depends on the first or second of these causes, the treatment consists in pinching up a longitudinal fold of the integument of the eyelid, and removing it by the knife or the scissors, great care being taken to raise and remove the precise quantity of integument necessary for obviating inversion, without inducing eversion. When it proceeds from the third cause, the swelling should be combated by treatment proper for the condition on which it depends. For the cure of entropium proceeding from contracted tarsus, various methods have been adopted. That practised by Tyrell, and uniformly successful in his hands, is to make a perpendicular section of the lid, near its centre, through its whole thickness. The tension is removed, and the wound granulates and leaves but little deformity.

ECTROPIUM.

By ectropium is meant eversion of the eyelid; a state which gives rise to—epiphora, or watering of the eye, owing principally to the displacement of the punctum; to irritation and excoriation of the cheek, induced by the secretion from the eye flowing over the cheek; to inflammation of the conjunctiva; and ultimately, if it be not removed, to structural changes both in the conjunctiva and the cornea. Exposure to atmospheric changes and lodgment of foreign matter are apt to induce inflammation in the palpebral and ocular divisions of the conjunctiva. Ectropium may proceed from acute or chronic enlargement of the conjunctiva lining the eyelid; from relaxation and elongation of the tarsus; from contraction of cicatrices on the face, from division of either canthus by wound; or from combinations of these conditions. The enlargement of the conjunctiva is to be treated according to common principles, and when other means fail and the condition becomes chronic, by excision; elongation is most successfully treated by excision of a part in the form of the letter V; contraction of cicatrices by removal of the cicatrices and transplantation of a portion of skin from the cheek or temple; and division of canthus, by making raw edges, bringing them into apposition, and preserving them in contact by suitable retentive means until union be accomplished.

DACRYOCYSTITIS ACUTA, OR ACUTE INFLAMMATION OF THE LACHRYMAL SAC.

Symptoms.—The symptoms are, pain of a deep-seated, throbbing, and lancinating character, principally in the situation of the lachrymal sac, but extending also to the surrounding parts; swelling, commencing underneath the tendo-palpebrarum, corresponding at first to the boundaries of the sac. The swelling is exceedingly tender to the touch, and hard at first, but afterwards becomes elastic, and ultimately acquires a feeling of fluctuation: it is very red and extremely painful, and as the inflammation extends to the surrounding parts, the redness becomes diffused, and the eyelids swollen and œdematous from effusion into the cellular tissue. The caruncula lachrymalis becomes inflamed, the puncta scarcely perceptible, and the transmission of tears through the lachrymal passages completely interrupted; hence the stillicidium lachrymarum, and the dryness of the nostril on the affected side, to the membrane of which the inflammation also frequently extends. If resolution do not take place, and suppuration occur, the matter makes its way to the surface by ulcerative absorption, and is discharged. As the inflammation advances, patients usually experience pain not only in the situation of the lachrymal sac and surrounding parts, but also in the head; and in severe cases they exhibit the usual symptoms of sympathetic fever. Fistula, permanent obstruction of lachrymal canals and duct, and extension of the disease to the periosteum and bone, are the dangers to be apprehended in severe and neglected cases. The disease usually originates in the mucous membrane of the palpebræ, and extends by continuity of surface to the mucous membrane of the sac; or commences in the mucous membrane of the sac without previous disease of the palpebræ: but in some cases it arises from inflammation in the subcutaneous tissue, and thence it extends to the sac; and in others, which fortunately are now of comparatively rare occurrence, the disease originates in the bone, and the soft parts of the lachrymal passages become secondarily affected. This comparatively limited class may be said to be in a great measure confined to scrofulous persons, who have been affected by syphilis, and whose constitutions have been injured and rendered irritable by the injudicious employment of mercury.

Treatment.—In very mild cases, resolution is in the early stage often speedily obtained under the use of the antiphlogistic regimen, and of cold and evaporating lotions; and in severe cases, suppuration is often averted by administering purgatives, antimonials, low diet, together with local abstraction of blood by leeches, and the use of cold and evaporating lotions. When symptoms of suppuration appear, warm applications medicated with anodynes should be used, and as soon as matter is discoverable, the sac should be freely opened by a vertical incision commencing immediately underneath the tendo palpebrarum; after which tepid water-dressings should be employed, and the parts syringed occasionally. By early, free, direct incision, structure may be saved and pain prevented.

DACRYOCYSTITIS CHRONICA, OR, CHRONIC INFLAMMATION OF THE LACHRYMAL SAC.

Symptoms.—If the disease be chronic from the commencement, and not a result of acute dacryocystitis, and if it run its course, the principal symptoms are the following:—The first stage is characterized by a watery eye; stillicidium lachrymarum; weakness of the eye; and impairment of vision from the accumulation of tears at the inner canthus. These symptoms are increased by using the eye, by looking at minute objects, or by exposure to cold and damp winds. There is slight redness, a feeling of uneasiness and fulness in the situation of the lachrymal sac, on pressing which the tears can be sent down through the nasal duct, and be made to regurgitate through the puncta: the tears are transparent, and not mixed with any muco-purulent secretion. The absence of muco-purulent secretion, the free passage for the tears through the nasal duct, and the power of completely emptying the sac by pressure, are characteristic peculiarities of this early period. The next stage is attended with some increase of redness, of uneasiness, and of swelling; the sac cannot be completely emptied by pressure, the nasal duct is generally obstructed, and the nostril dry; and when the sac is pressed, tears and opaque muco-purulent secretion are seen to regurgitate through the puncta. This stage has received the name of Blennorrhœa, on account of the discharge of thick mucus along with the tears. In the third stage, all the symptoms are of a more decided character; the swelling increases, matter forms, and makes its way by ulcerative absorption to the surface.

This is the stage of suppuration, and ulcerative absorption. After the discharge of the matter, the disease may subside, or it may again assume the characters of the previous stage called Blennorrhœa; or further collections may form, and make their way to the surface by fresh ulcerations of the parietes; or the disease may degenerate into true fistula lachrymalis. In this disease a speedy cure is most desirable, not only for the same reasons which apply equally to other diseases, but also because, when it is of long standing, there is risk of the periosteum and bone becoming ultimately involved, constituting the condition called carious fistula. This risk is greater in scrofulous persons than in others. This condition of parts can be discovered by examination with the probe; but generally manifests itself by the offensive smell of the discharge, as well as by other symptoms common to all sores which are situated over bones affected with caries. There are the same varieties as to the structures in which the disease commences in the chronic, as in the acute form of the affection; and here, also, the comparatively small class in which it originates in the bones, is composed chiefly of scrofulous persons who have become affected with syphilis, and been injured by mercury; and those in whom there is the greatest danger of the bones becoming secondarily affected, belong also to the same unhappy class.

Treatment.—To improve the general health by suitable treatment is, in all cases and in every stage, a most important indication. In the first and second stages, the principal points of local treatment are the occasional emptying of the sac by gentle pressure, local depletion by means of leeches, cold applications to the inflamed parts, the application of a gentle stimulating ointment to the edges of the eyelids at night, bathing the eye at times with astringent collyria, and cleansing the lachrymal passages occasionally by means of Anel's syringe. The last-mentioned proceeding is important in all cases, except when the action is very acute, or the nasal duct completely obstructed. In the stage of suppuration, the use of warm applications and early and free incision constitute the proper proceeding. Here, as in the acute variety of this disease, both suffering may be prevented and texture saved by early incision; and no good can result, but much harm may, from delaying the adoption of this proceeding, after its necessity has become apparent.

FISTULA LACHRYMALIS, AND OBSTRUCTION OF THE NASAL DUCT.

The varieties with regard to the different tissues, in which the morbid action eventually terminating in fistula lachrymalis may originate, and the symptoms and anatomical conditions of that disease, may be clearly understood from what has been already stated. It is only necessary, therefore, here to remark that, although obstruction of the nasal duct may exist to some degree for a considerable time without fistula lachrymalis, yet it is always present in fistula lachrymalis, and indeed furnishes the condition which it is a paramount indication to remove, in order to cure the fistula: and that, although in the early stage, this obstruction may for some time depend on congestion and inflammation, without much or any organic change, and may in such cases yield to remedies for improving the general health along with the use of local depletion, stimulating ointments, astringent collyria, and some of the mildest forms of counter-irritation, yet in the more advanced stage, it depends on organic changes caused by exudation into the submucous tissue, and the texture of the mucous membrane itself, and can be removed only by operation. The only instruments necessary for the performance of this little, neat, and very satisfactory operation are, a narrow, straight bistoury, a silver probe, and a style. The patient having been seated on a chair, the operator makes an incision in the common integument, at the under border of the tendo palpebrarum, and sends the knife into the lachrymal sac and the commencement of the nasal duct, by directing it downwards, very slightly backwards, and a very little inwards. The knife is then withdrawn, and the probe sent down through the canal into the nose, and on withdrawing the probe, the style is immediately lodged in the canal, when the operation is finished. I have, in several instances, dispensed with the use of the probe, and sent the style at once into the canal on withdrawing the knife. There are three simple directions, attention to which will enable the surgeon to perform this operation very quickly and neatly; namely, to introduce the knife at the under border of the tendo palpebrarum; to hold the several instruments as much in a vertical direction as the forehead will permit; and in sending them downwards, to keep them slightly backwards and inwards, close to the mesial side of the lachrymal canal, which can easily be found, as it is immediately behind the ridge, on the nasal process of the superior maxillary bone. If these directions be attended to, the instruments cannot, unless force be used, be sent into any part except the lachrymal canal. The broad little head of the silver style rests on the common integument, and as it is made black, to a careless observer it looks like a little bit of black plaster below the inner canthus. The presence of the foreign body excites a degree of inflammation, in consequence of which the style ceases for a short time to be loose in the canal; but this soon wears off, after which the style should be removed every day or two, and the canal cleansed by means of Anel's syringe; and when the surgeon is perfectly satisfied as to the permeability of the canal, and the sound condition of its lining membrane, the use of the style may be discontinued. After this, the opening generally heals up without interference; if not, the gentlest possible touch with nitrate of silver, or a hot wire, will promote occlusion. I have been much gratified with the result of this very satisfactory operation. To other modes of proceeding my limits will not permit me to refer.

CHAPTER XXX.

AFFECTIONS OF THE EAR.

Superabundance of Wax.—Deafness frequently arises from an accumulation of wax in the external meatus, mixed with hair and cuticle. In such case, examination should be made, not with the probe, but with the speculum. The speculum contrived by Toynbee is most convenient. If the membrana tympani be not inflamed or dry, and the passage be not devoid of wax, then the syringe should be used—one which will work easily and accurately, so that no air bubbles be squirted in. A few drops of oil or glycerine should be introduced for a few nights, to soften the wax, and on injecting warm soap and water into the ear, the hardened cerumen is brought out by the regurgitation of the fluid.

The best kind of syringe is a metallic one. For applying lotions or injections, a small elastic bottle answers best. With Margett's small elastic suction-bottle, which is furnished with a tube, a patient may pass a gentle stream of warm water into his own ear, by way of fomentation. This, in a case of pain or inflammation, is very soothing.

Foreign substances in the Ear.—Serious effects at times result from children putting little articles into the passage of the ear, such as peas, beads, bits of slate-pencil, and the like. Violent inflammation and deafness may ensue. If such body can be removed gently, either by the syringe and warm water, or by a small forceps curette, or scoop, no time should be lost in making the application. But if it cannot be removed gently, it must be left, in the hope that it may become coated with wax, and the passage enlarged by interstitial absorption, when it may be removed without trouble. Nothing, however, should be attempted without examination with the speculum, lest in making a vain search for a supposed object, real injury be caused to the ear.

OTORRHŒA.

Otorrhœa is a discharge, purulent or muco-purulent, from the external auditory passage.

A frequent cause of this affection is *catarrhal inflammation* of the lining membrane of the meatus, which is excited by cold or stomach affection, especially in teething. It may accompany strumous ophthalmia, porrigo, and other eruptions; or it may be a sequel of the exanthemata, or of any weakening illness. The child is first feverish, and complains of ear-ache; the meatus is swelled and vascular, and speedily there occurs a thin yellowish discharge.

The treatment consists in administering a purgative, and applying a fomentation or a large bran poultice in the early stage; the discharge should be constantly washed away; and if this prove obstinate after health is restored, astringent applications must be used. Some parents entertain the notion that an habitual discharge is beneficial, and that there is fear of driving it in upon the brain. Of this they should be disabused.

When this purulent discharge follows internal otitis, the general health must be promoted by tonics, alteratives, and aperients, as also by *warm* baths. For the local disease the cautious use of stimulants and astringents is the proper treatment. Twice a-day the warm water syringe should be *very gently* applied; immediately after which a tepid lotion of alum, or sulphate of zinc, or acetate of lead, should be dropped into the meatus, and after two or three minutes allowed to run out.

If the discharge is very fœtid, a lotion should be used, composed of two drachms of solution of chloride of lime to half a pint of water. If the case is obstinate, the whole interior of the meatus should be pencilled with a solution of the nitrate of silver (gr. v. ad ℥j) twice a week, with a camel's-hair pencil. If excoriation of the auricle or the neck is produced in consequence of the discharge, these parts must first be fomented, and then smeared with an ointment of hyd. præcip. alb., though it is not advisable, in general, to insert ointments into the meatus. If, in the meantime, an attack of acute pain and fever should occur, and the discharge should stop suddenly, the astringent applications must be given up for the time, and leeches, purgatives, and fomentations applied.

A *thickened* state of the *cuticle* lining the meatus is at times the consequence of neglected otorrhœa. All loose flakes of cuticle, together with the discharge, must be removed by syringing with warm water. Then the membrane is to be brushed over with a weak solution of nitrate of silver, and afterwards with dilute citrine ointment, melted and applied warm with a brush. The duty of cleanliness, in reference to this affection, cannot be too strongly inculcated.

Polypus.—Of this there are two sorts—the first, according to Mr. Wilde, consisting of fleshy pedunculated growths, nearly colourless, having a thin cuticular covering, unattended with pain, not appearing as the result of inflammation, and not accompanied with discharge, usually attached to the middle glandular portion of the meatus, and extremely rare; the second sort are very common, growing chiefly from the bottom of the meatus, the consequence of otorrhœa, always attended with discharge, in size usually like a pea or bean, though at times much smaller, as well as much larger, even so as to project from the meatus. The colour, when small, is usually a florid red. Some removed by Mr. Harvey consisted of fibro-plastic cells, with more or less of perfectly developed fibro-cellular tissue, and of almost structureless gelatinous substance.

In addition to these, may be mentioned another tumour found in the external meatus—namely, cancer. In its earliest stage, this may not be distinguishable, unless it be removed and subjected to the microscope; but in time, the true state of things will be discovered by the rapid return of the growth, by the occurrence of palsy in the face, and other signs of the contamination of neighbouring organs.

Treatment.—The polypus is to be completely removed by means of the forceps or a pair of scissors; the point of its attachment touched with lunar caustic, from time to time, when it threatens to sprout again, and the meatus regularly syringed with an astringent lotion.

The lunar caustic should be cast in very fine sticks, like the leads of a patent pencil; or the tip of a fine probe should be coated with it, so that it may be applied exactly to the right spot.

Fungous Granulations.—These are very common consequences of otorrhœa. They are generally found at the bottom of the meatus, or shooting from the membrana tympani, or from the cavity of the tympanum, after the membrane has been perforated by ulceration. Sometimes the membrane is covered with florid granulations, so as to resemble the *granular conjunctiva.*

Treatment.—The solution of nitrate of silver should be regularly applied by means of a camel's-hair pencil; astringent washes should also be injected.

Affections of the Eustachian Tubes.—The opinion at one time entertained was, that these tubes are constantly open for allowing uninterrupted passage of air to the cavity of the tympanum; but the belief now generally adopted is that brought forward by Mr. Toynbee, namely, that their orifices are shut except during the act of deglutition; that during this act, the levator and tensor palati muscles, to use the words of Mr. Toynbee, "open the guttural orifice of the tube, afford free egress to the mucus secreted by the lining membrane of the tympanum, and allow the air to enter or to leave the tympanic cavity." This has been supposed to furnish the explanation of the fact, that the uneasy sensation felt in the situation of the membrana tympani by those who descend in a diving-bell is relieved by swallowing, the pressure on the inner side of that membrane being made equal to that on the outer by the passage of condensed air into the tympanic cavity. It is also believed by Mr. Toynbee that this view of the condition of the tube furnishes the explanation of two other facts—the one, that if, while the mouth is shut and the nostrils closed, by being compressed between the finger and thumb, an attempt be made to swallow, a sensation of fulness and pressure will be experienced in the situation of the membrana tympani, owing to the air being forced through the open tube into the cavity of the tympanum; the other, that this sensation continues until the next act of deglutition performed in ordinary circumstances, when it is instantly removed. A pervious, though not constantly open condition of the Eustachian tubes being required for perfect hearing, it is easy to understand how the various forms of obstruction of these tubes should be ranked among causes of deafness. Some of the more common conditions which cause obstruction are, an inflamed state of the membrane in common catarrh, constituting throat or catarrhal deafness, or relaxation of the mucous membrane of the throat, or enlargement of the tonsils. Other conditions, not of so frequent occurrence, but which cause deafness, are, congenital occlusion, inflammation, mechanical obstruction, and stricture. It is important to determine the condition of the Eustachian tube, and more particularly as to whether or not it be pervious. In addition to the proceedings mentioned above, it may be stated, that if the bell of a flexible stethoscope be placed over the ear of a patient, and the other extremity applied to the surgeon's ear, and if the patient then, with his mouth shut and his nostrils closed, makes an effort to swallow or to blow his nose, if the Eustachian tube be pervious, the surgeon may hear the shock of the air against the membrana tympani; and if it contain mucus, a gurgling or squeeling sound, as it has been called, giving rise to an impression of fluid and air mixed together, will be conveyed.

Treatment.—If the cause of obstruction be a grade of the inflammatory process, the treatment should be conducted according to the ordinary principles for the treatment of that state, and it ought to be carried out with energy proportioned to the activity of the morbid action. In some individuals of a weak and relaxed habit of body, relaxation and swelling of the mucous membrane of the throat, and in others, chronic enlargement of the tonsils, give rise to deafness, no doubt owing to the swelled mucous membrane of the Eustachian tube causing obstruction of that canal. Tonic treatment, and, in many cases, the use of all remedies proper for the scrofulous diathesis, and in the first-mentioned class of cases, brushing over the throat with a strong solution of the nitrate of silver; and in the second, removing the tonsils in the manner described in a former chapter, are proceedings which not only add much to the comfort of the patients, but, as I have often seen in my own experience, are followed by removal of deafness. I have never seen in my own practice, either public or private, any inconvenience to result from removing the tonsils, and the tendency to swelling and inflammation is in general cured by their excision; and that, no doubt, is the explanation of the improvement of the hearing, which, in cases of throat-deafness, follows their removal. From catheterism of the Eustachian tube I have never seen any advantage. I am perfectly aware of the diversity of opinion regarding this proceeding; but, judging from my own experience, I am of opinion that catheterism of the Eustachian tube, and puncturing the membrana tympani, are useless operations. After a good deal of practice on the dead body, there is no difficulty in sending a small probe, slightly bent at its distal extremity, into the Eustachian tube. A convenient mode of doing so is, to send it along the floor of the nostril with the point downwards, and on the instrument reaching as far as the fauces, if it be kept along the outer wall of the nostril, and the point directed outwards and backwards, it readily enters the Eustachian tube.

OTITIS INTERNA.

Otitis interna, or inflammation of the tympanal cavity, may be either acute or chronic. When acute, it is characterized by pain of an excruciating character, generally worse at night, and increased by speaking, sneezing, coughing, or swallowing. It is accompanied by a feeling of distension of the aural cavity, and by great tenderness on touch. Fever of a violent nature is a frequent concomitant. In many instances, the inflammation terminates in a purulent discharge, which finds its way to the meatus externus through ulceration of the membrana tympani.

In very severe cases in which suppuration occurs in the tympanum and mastoid cells, there not unfrequently result either obstinate otorrhœa, caries of the bone, irritation of the membranes of the brain, abscess within the brain substance, or even general pyæmia.

The complaint commonly arises either from exposure to cold, or from violence done to the ear.

In subacute or chronic inflammation of the tympanal cavity, the symptoms are frequently such as to attract little attention, till the disease has lasted for a long time. The patient suffers at times from pain of a rather trifling character and short duration, from noises in his head, and from gradually increasing dulness of hearing, which in many instances is the first thing that attracts his notice. In the first stage of acute inflammatory attacks, the membrana tympani appears opaque and vascular, and the meatus swollen, red, and dry. In chronic cases, suppuration occurs within the tympanum and mastoid cells, the membrana has a thickened appearance, and is often covered with cheese-like or fibrous concretions. Exudation of lymph takes place, causing the formation of bands stretching across the cavity, or else entirely blocking it up; and ultimately the little lines become diseased and detached, the membrana tympani ulcerated, and entire disorganization of the middle ear takes place.

Acute inflammation in the tympanal cavity requires prompt and decided antiphlogistic treatment. The local measures of greatest advantage in this complaint are, leeching behind the ear, continuous application of poultices or warm fomentations, and blistering when the violence of the inflammatory action is subsiding. In cases where there is any swelling or sense of fluctuation over the mastoid process, Mr. Wilde strongly recommends the making of an incision down to the bone, about an inch behind the auricular attachment, and in a line parallel to it.

In cases of chronic inflammation within the tympanal cavity, great attention must be paid to improve the state of the general health. In cases occurring in strumous subjects, cod-liver oil and tonics must be employed; and should the disease arise in those of a rheumatic or gouty diathesis, the remedies suited for these habits must be adopted. Any increase of inflammatory action must be combated by judicious local depletion, and by properly timed counter-irritation.

DEAFNESS.

Deafness may proceed from many causes beside the affections already described. Some of these are the following: Deficiency of cerumenous secretion is an occasional, but by no means very frequent cause. It is characterized by an empty and dry state of the meatus, and a glistening and clear state of the membrana tympani. Stimulation of the meatus by the essential oils much diluted, and friction around the auricle, are the most useful remedies. Ulceration and perforation of the membrana tympani, hypertrophy of bone, and inflammation of the middle or internal ear, in other situations than those already mentioned, are causes of deafness. Functional disorder of the nerve is believed to be a cause of deafness. It is supposed to proceed from torpor or debility, and is very variable, being greater at some times, and less at others. Mr. Toynbee, however, has shown that many of the cases of supposed nervous deafness really depend on some chronic form of inflammation of the lining membrane of the tympanic cavity. Disease of the deep-seated osseous textures, fractured bone, concussion, compression from extravasated blood or morbid effusions, disease of the auditory nerve, and inflammation, tumours, or organic changes in the brain, are not unfrequent causes of deafness. In some of these last-mentioned particulars the pathology of deafness resembles that of amaurosis; and both diseases sufficiently demonstrate, in too many instances, the limited efficiency of the most skilful treatment which it is possible to adopt.

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Page 793, line 23, omit the comma after whalebone.
,, 795, line 11 from bottom, for *on* read *and*.

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